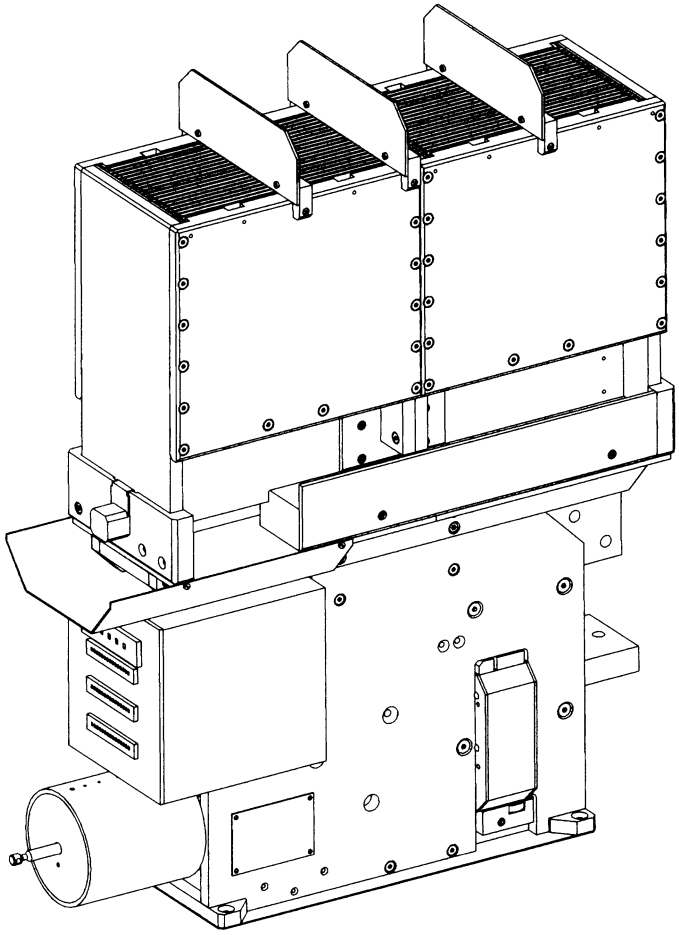
GE Consumer & Industrial
Power Protection



High Speed DC Circuit Breaker

Gerapid 2607, 4207, 6007, 8007 with arc chutes 1X2, 1X4, 2X2, 2X3, 2X4

USER MANUAL

INDEX

1. WARNINGS 4

2. GENERAL USAGE CONDITIONS 4

2.1 Transportation and storing 4

2.2 Installation 5
2.2.1 Operational environment 5
2.2.2 Installation and interfaces 5

2.3 Usage 5
2.3.1 Supply and load 5
2.3.2 Adjusting the over current release 5

3. TECHNICAL INFORMATION 6

3.1 Introduction 6

3.2 Components and accessories 6
3.2.1 Contact system 6
3.2.2 Arc chute (Code 2) 6
3.2.3 Mechanism 7
3.2.4 Over current release (Code 7) 7
3.2.5 ED impulse coil release (Code 12) 8
3.2.6 Auxiliary tripping devices (Code 11) 8
3.2.7 Forced tripping release (Code 13) 8
3.2.8 Lever for manual operating (Code 16) 9
3.2.9 Auxiliary switch (Code 9) 10
3.2.10 Indicators 10
3.2.11 Solenoid closing drive (Code 3) 10
3.2.12 Current measurement system (Code 6) 11
3.2.13 Electronic control system 11

3.3 Technical data tables 13

4. ELECTRICAL CIRCUITS 15

4.1 Controls layout 15

4.2 Terminals wiring system 16

4.3 Electrical diagrams 17
4.3.1 Wiring code 17
4.3.2 Controls supply circuit 18
4.3.3 ED coil with external capacity bank 19
4.3.4 NEKO control circuit 20
4.3.5 SU control circuit 21
4.3.6 Shunt trip control circuit 22
4.3.7 Zero voltage release control circuit 24
4.3.8 Indicators 25
4.3.9 Auxiliary switch 26
4.3.10 SEL measuring system 27

5. DIMENSIONS & SAFETY DISTANCES 28

5.1 Safety distances. 29

5.2 Outlined dimensions 30
5.2.1 Gerapid 2607,4207, 6007 with arc chute 1x_ 30
5.2.2 Gerapid 2607, 4207, 6007with arc chute 2x_ 31
5.2.3 Gerapid 8007 with arc chute 1x_ 32
5.2.4 Gerapid 8007 with arc chute 2x_ 33
5.2.5 Gerapid 2607, 4207 with H / H terminals 34
5.2.6 Gerapid 2607, 4207 with V / V terminals 35
5.2.7 Gerapid 6007 terminals 36
5.2.8 Gerapid 8007 terminals 37

6. INSPECTIONS AND MAINTENANCE 38

6.1 List of inspections 38
6.1.1 General visual inspection 39
6.1.2 General functional inspection 39
6.1.3 Inspection of the arc chute 39
6.1.4 Inspection of the contact system 40
6.1.5 Inspection of contacts' tilt and gap 41
6.1.6 Inspection of the screw connections 41
6.1.7 Inspection of the mechanical components 41

6.2 List of maintenance works 42
6.2.1 Contact system (after 11/2003) 43
6.2.2. Contact system (before 11/2003). 44
6.2.3 Layout of control PCB inside control box 46
6.2.4 Replacement of the control boards 46
6.2.5 Adjusting the auxiliary switch 48

6.3 Spare parts lists. 49
6.3.1 Mechanical spare parts. 49
6.3.2 Electrical spare parts. 50
6.3.3 Recommend materials for selected works. 50

7. CUSTOMER SUPPORT 51

7.1 Options overview. 51

7.2 Ordering. 52
7.2.1 Example of order no. 1 53
7.2.2 Example of order no. 2 54
7.2.3 Example of order no. 3 55

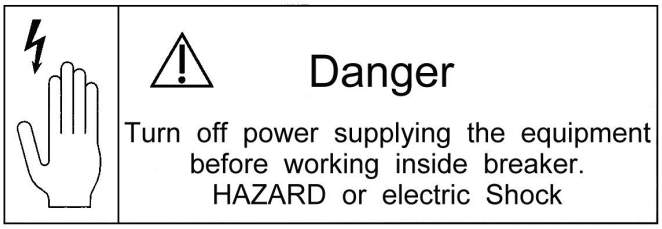
7.3 Glossary 56

7.4 Troubleshooting 57

7.5 GE service teams 58

7.6 Notes 59

1. Warnings



Warnings:

During operation, electrical equipment carries dangerous voltages. In addition, circuit breaker emits hot, ionized gases when switching currents, especially short circuit currents.

Installing, commissioning, maintaining, changing or refitting of this equipment must be carried out only by qualified and suitably trained personnel and under strict observation of national and international applicable safety regulations.

During their operation, circuit breakers must be equipped with appropriately fitted covers, e.g. in suitable enclosures or panel boards. Safety distances must be preserved. Suitably trained service personnel shall only carry out certain works.

Non-compliance with these warnings may result in death, and/or severe physical damage and extensive damage to equipment.

Prior to carrying out maintenance, inspection or checks, the circuit breaker must be open, the both terminals must be grounded, the circuit breaker must be switched off and the control plugs removed.

Manual activation of the breaker while energized is forbidden. Manual activation must only be used for maintenance and inspection purposes, when breaker power is off and grounded.

The circuit breaker consists of high energy moving components. Do not touch the circuit breaker while it is being switched ON (closing) or OFF (opening). There is a high risk of major injury.

The control circuits may include capacitor banks, which can be charged with dangerous voltages. Work on this section must be carried out carefully.

2. General usage conditions

2.1 Transportation and storing

- The breaker is transported on wooden palette. It is fixed by shrunken plastic film. A cardboard box covers the breaker on the palette. Truck, railway, airplane and ship transport is possible. In case of sea transport, special protection against salty and humid environment is provided.
- The circuit breaker must always be transported to the installation site vertically and fully packed. The packaging protects the device against damage and dust; it should only be removed prior to installation.
- If the packaging is damaged, the breaker and the arc chute must be inspected for damage. Ensure that all packaging materials have been carefully removed prior to breaker installation.
- For handling the unpacked breaker use canvas slings and position them below the closing drive **(a)** and below the **lower** terminal **(b)** [Fig. 1].

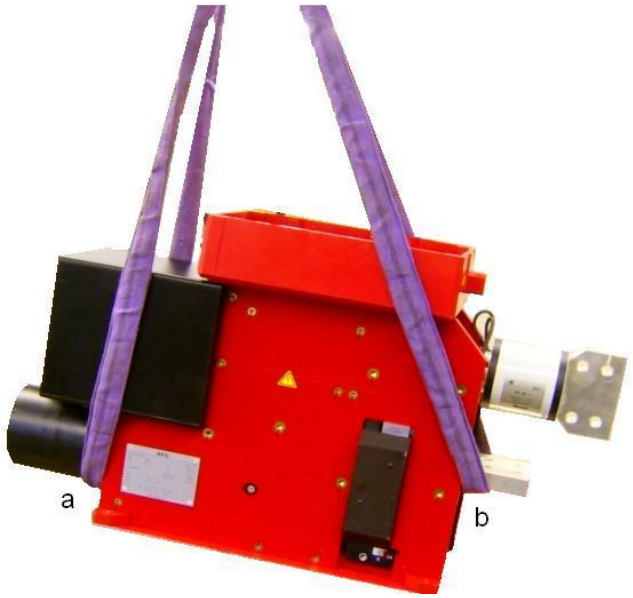


Fig. 1 Handling the breaker

- **WARNING:** Breaker and arc chute must be transported separately. Never handle the breaker with arc chute installed at!
- Take care that the bottom isolation plate of the unpacked breaker is not damaged during handling. Do not push the breaker back and forth on any rough surface.
- The breaker's weight, including arc chute is listed in Table 1, page 13. Arc chute's weight is ca. 30 kG (66 lb) for "1x_" type, and ca. 60 kG (132 lb) for "2x_" type

WARNING:
- Store in original packaging!
- Do not store outdoors!
- Use protection against crush and blow!
- Do not store the breaker in a damp area!
- Storing temperature-range –25 °C...+55 °C!

2.2 Installation

2.2.1 Operational environment

- The breaker, as delivered, is IP00 (NEMA 1) protected. It is intended to work in indoor applications, without pollutions, with non-conductive dust, protected against high humidity and condensation. Low conductivity dust deposit due to frequent condensation of humidity is acceptable. General environmental conditions refer to EN 50123-1 - annex B, and IEC 60947, class PD3.
- The breaker can operate at rated current within ambient temperature range of –5 °C to +40 °C (23 to 104 °F). Maximum operating ambient temperature is +55 °C (130 °F) with continuous current derated by 10 %.
- The breaker can operate at altitude up to 2000 m (~6500 ft) without derating.
- The breaker shall not be subjected to strong vibrations. Maximum vibrations of 0.5 g per 30 sec in vertical and horizontal directions are allowed.
- Air shall be clean and its relative humidity shall be not more than 50 % r.h. at the maximum temperature of +40 °C (104 °F). Relative humidity may be higher if the temperatures are lower, for example, 90 %r.h. at +20 °C (68 °F). Slight condensation might occur during variations of temperature

2.2.2 Installation and interfaces

- The lower and upper main terminals (Code 4) must be connected directly to the main cables or bus bars.
- **WARNING:** The breaker must only be used in an upright operation position with the arc chute in place and fully secured.
- After arc chute installation check for tightness both connections to the arc runners. See drawing 49, item 3.
- The safety distances as listed in section 5.1 shall be maintained to grounded or insulated parts. Suitable measures must be taken to protect personnel from arcs.
- Strong, external magnetic fields, caused by improperly located supply conductors or stray fields from other devices, can lead to a shift of the trip setting thresholds. This may result in premature tripping, or no tripping at all during low-level short circuit current events. This has to be accounted for when installing and operating the device with shielding added if appropriate.
- The control wires must be connected to the control terminals (Code 19), as shown in the schematic circuit diagrams in section 4. The protective grounding wire must be connected at the marked contact [Fig. 2].

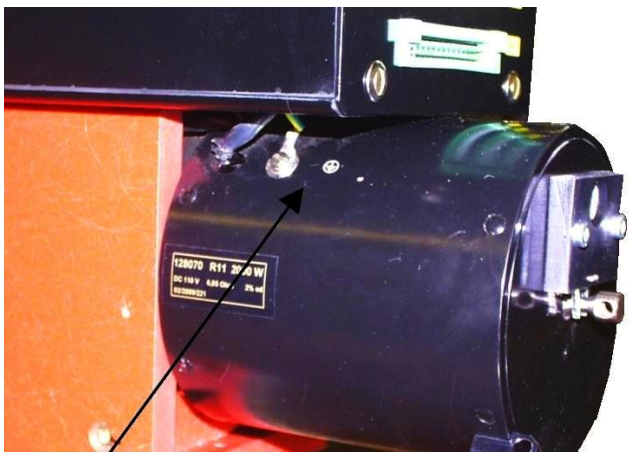


Fig. 2 Termination for grounding wire

2.3 Usage

2.3.1 Supply and load

- In accordance with its type, the breaker has been designed for the current and voltage listed in Table 1, section 3.3.
- During continuous operation, breaker must only be loaded up to its maximum rated current. Load currents in excess of breaker nameplate rating are allowable for brief periods. Refer to the short time currents listed in Table 1.
- Do not exceed the rated operating voltage shown on the breaker's nameplate.
- Supply voltage for the drive and the auxiliary-tripping devices (Code 8) shall be within the specified control voltage range. Maximum current values for the auxiliary-tripping devices are listed in Table 2a.
- **WARNING:** Plugging in or unplugging of the auxiliary connectors (-X2 :1/:2) (-X3 :4/:5) is only allowed with disconnected primary (mains) and secondary voltages.

2.3.2 Adjusting the over current release

- OCT is an over-current tripping release (Code 7), which trips and releases the breaker in case of overload or short circuit currents. This is an instantaneous and direct acting device.
- If equipped with an adjustable OCT, the response threshold can be easily adjusted [Fig.3], by turning the adjustment nut 1 with a SW6 hexagon wrench 2.
- The adjustment must only be carried out after the breaker has been disconnected from the main circuit. For fixed installations breaker's main terminals shall be grounded.
- Turning the adjustment screw clockwise increases the trip threshold, turning the screw counter-clockwise decreases the tripping threshold.
- Align the arrow and the desired marking 3, to perform adjustment.

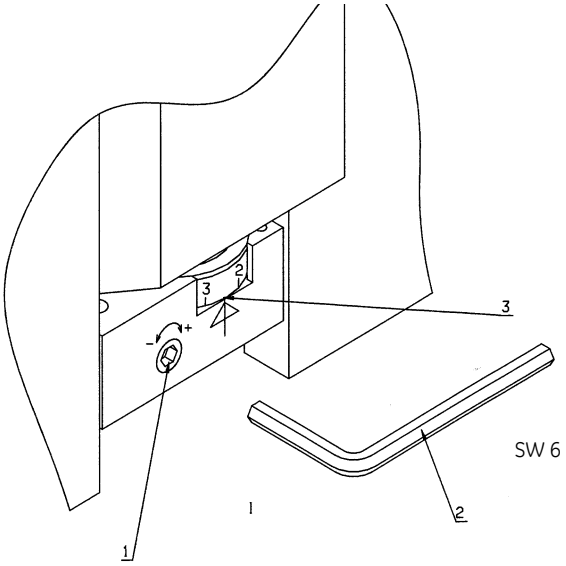


Fig. 3 Setting of the OCT unit

3. Technical information

3.1 Introduction

- Gerapid is a high-speed DC circuit breaker. This is a single-pole DC breaker, primarily designed for use in railway power distribution systems with operating currents up to 8000 A (Code 1) and operating voltages up to 3600 V (Code 2). Additional applications are special industrial plants such as electrolysis, mining or steel mills.
- Gerapid breaker has a very high interruption capacity combined with a current limiting characteristic. The arc chute works on the basis of an asbestos-free arc splitting principle.
- A wide variety of accessories and spares are available for maintenance, repair, or as a possible enhancement.
- Use the catalogue coding system described in section 7.1 to configure the breaker. Each rating, option or accessory has own code.
- Closing of the circuit breaker is performed through a high-power solenoid drive (Code 3).
- During inspections, opening and closing may be carried out by means of a hand lever (Code 16), which is mounted onto the armature of the closing drive.
- Overload tripping and release is obtained directly by means of the OCT release (Code 7), or optionally by ED impulse release (Code 12). Indirect remote tripping can be achieved by means of a shunt trip, or optionally by a zero voltage release (Code 11).
- Gerapid breakers have a compact and enclosed construction [Fig. 4]. Gerapid is IP 00 protected. All parts are mounted on thick-walled, non-breakable and fireproof insulation panels.

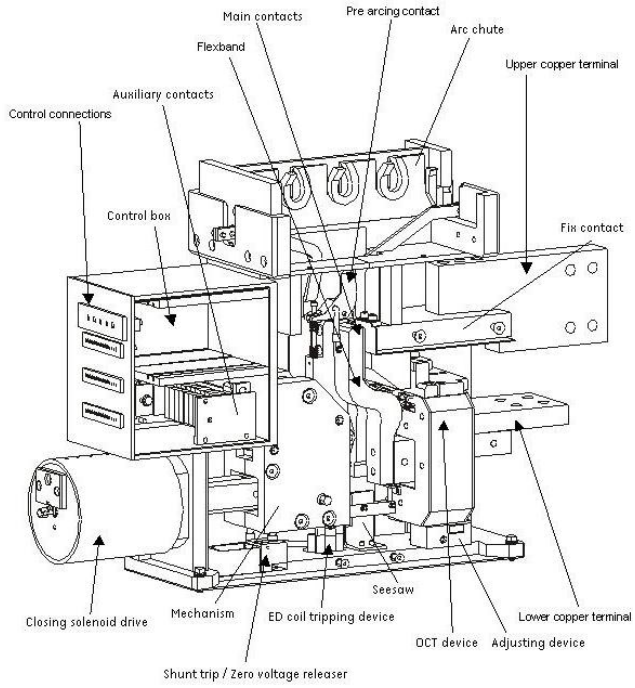
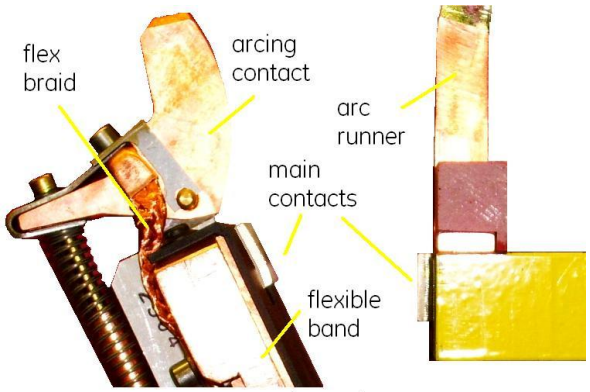


Fig. 4 Modular construction overview

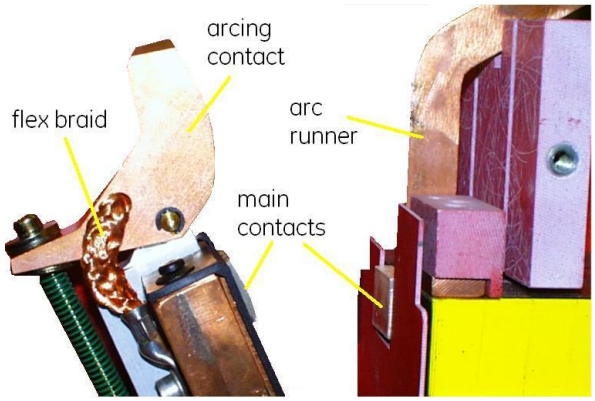
3.2 Components and accessories

3.2.1 Contact system

- All Gerapid breakers are equipped with a two-stage contact system [Fig. 5], consisting of a main contact and an arcing contact. With this proven design, the main contact is not subjected to any appreciable wear or tear.
- The main contact is made of a silver composite material. The arcing contact and link braid are made of copper and can be easily replaced.
- The flexible bend is linked to the arcing contact by means of very tight braid.



Contact system after 11/2003



Contact system before 11/2003

Fig. 5 Two types of the contact system

3.2.2 Arc chute (Code 2)

- Compact and modular design of the arc system requires no additional magnetic support and allows small safety distances with high breaking capacity.
- Because of the compact dimensions, these breakers can be installed in extremely small enclosures (from 500 mm; 1.65 ft) and offers a cost-effective solution for replacements.
- An adaptor [Fig.43] is used to mount the various arc chutes for different operating voltages on the breakers.
- The arc chutes consist of a highly durable, arc-proof material, in which the arc plates have been integrated.
- The arc plates split the arc into partial arcs and increase the arcing voltage by multiplying the anode and cathode voltage drop. Because of their high heat capacity, the plates and arc chute walls absorb a large amount of the arc's energy.

3.2.3 Mechanism

- The Gerapid is equipped with a modular designed mechanism, which is wear-resistant and nearly maintenance-free. This mechanism ensures an extended electrical and mechanical endurance of the breaker as well as a high level of safety under all operation conditions.
- Breaker can operate 20 000 cycles when opened by the shunt trip or zero voltage release, and 1 000 operations by means of ED impulse coil or OCT releases.
- This mechanism is mechanically latched in the CLOSED position. The principle of a mechanically latched mechanism offers a big advantage compared to often used electro magnet holding system. No auxiliary control power source is required to keep breaker closed.
- The mechanism is provided with two tripping latches [Fig. 6]. First latch, called "slow latch", is used for opening under normal conditions, like actuation of shunt trip or zero-voltage release. The second one, "quick latch", de-clutches the main contact arm from the mechanism and opens the contacts with an extremely short delay. This is used when interrupting short-circuit or overloads. All safety releases operate onto "quick latch" latch.
- Different main springs are used in mechanisms for different breaker frames. Therefore mechanisms cannot be exchange between breakers of different frame.

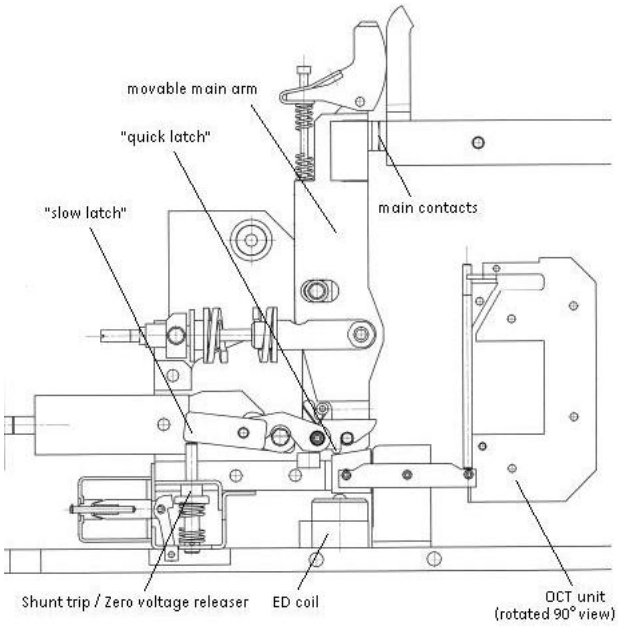


Fig. 6 Latching and tripping system

3.2.4 Over current release (Code 7)

- The OCT release is a magnet with two magnetic circuits, optimizing the twin magnetic field principle [Fig. 7]. This technology ensures equally fast tripping in both current directions. This system does not require an auxiliary control voltage to operate. It is a direct acting and instantaneous tripping device.
- The OCT consists of the holding circuit [6], the movable armature [3] and the tripping circuit [7]. The holding and the tripping magnetic circuits are both excited by load current [1]. Until the static overload release's response threshold has been reached, the armature [3] is held in position by the holding flux (ΦH) [2] and the counter spring's force [4]. Once the load current exceeds the set static response threshold, the attraction flux (ΦA) [2] takes over and rapidly pulls down the flexible armature [3]. During this operation, the armature hits the seesaw, which releases the quick latch in the mechanism. The latch and contacts are opened immediately.
- The response threshold can be easily adjusted by turning the adjustment nut with a SW6 hexagon wrench. The available ranges are described in the table below. Other ranges might be possible on request.
- When supplied with the optional transparent side protection covers (Code 15), a fixed mounted insulated knob is provided to enable OCT adjustment [Fig. 16].

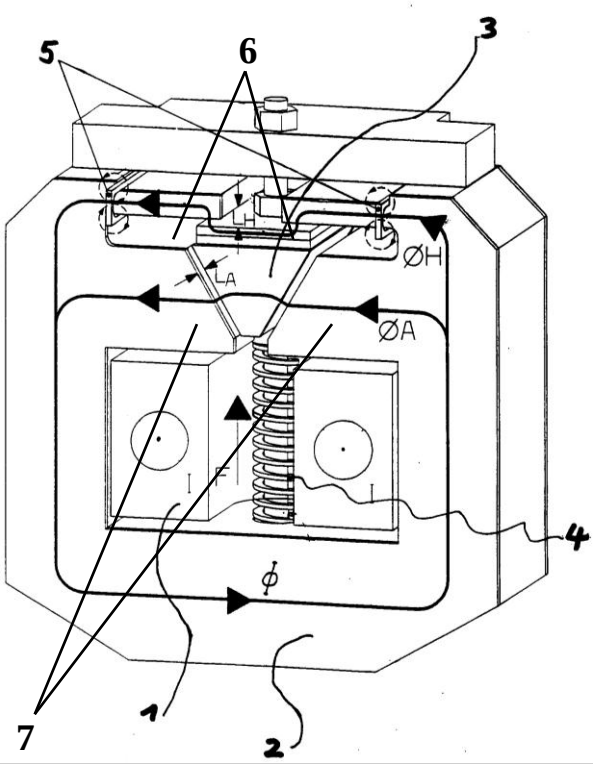


Fig. 7 OCT device.

Default tripping bands for the OCT release [1,2].

No	OCT band	2607	4207	6007	8007
1	1,5 kA - 2,5 kA				
2	1,5 kA – 3 kA				
3	1,5 kA – 4 kA				
4	1,5 kA – 5 kA				
5	2 kA – 6 kA				
6	2 kA – 7 kA				
7	2 kA – 8 kA				
8	2,5 kA - 5,5 kA				
9	3 kA – 7 kA				
10	3 kA – 8 kA				
11	3 kA – 9 kA				
12	3 kA – 12 kA				
13	5 kA – 10 kA				
14	6 kA – 14 kA				
15	7 kA – 15 kA				
16	8 kA – 18 kA				
17	10 kA – 16 kA				
18	12 kA – 24 kA				

1) Customer specific bands on request.
2) Tripping accuracy ±10%.

3.2.5 ED impulse coil release (Code 12)

- ED impulse release requires an external protective relay for monitoring a current increase. This relay must be provided and installed by the customer.
- If a fault occurs, an external relay signal wired into the capacitors' control unit (internal NEKO or external C-bank), causes NEKO unit to discharge its energy into ED coil [Fig. 8]. The coil trips the breaker's quick latch and opens breaker's contacts in less 3ms.
- ED impulse release is an optional accessory. Complete set consists of ED coil and electronic control unit with C-bank called NEKO. The external release signal shall be 8 V to 24 V DC, and shall be connected at terminals (-X2 :10 / :11) in standard wiring scheme.
- Customer supplied capacitor trip unit may be used. Rated voltage of 300 V and capacity of 2 000 µF is required. In this case only ED coil will be installed in the breaker.
- **WARNING:** Firing signal voltage level is between 8 V and 24 V. There should be no spikes on the signal of duration less 3 ms. This can lead to defect of the NEKO board!
- **WARNING:** Maximum duration of the firing signal must not exceed ~1 sec. Longer signal can lead to NEKO overheat! It is recommended to use an auxiliary contact in serial connection with firing circuit (-X2 :10/:11). It will automatically cut off the firing circuit after breaker opening.

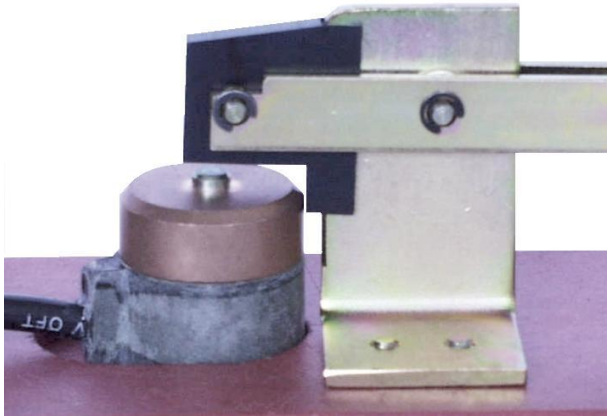


Fig. 8 ED impulse coil with seesaw interface

3.2.6 Auxiliary tripping devices (Code 11)

- The breaker can be equipped with either a shunt trip (ST) or a zero voltage release (UVR). It is not possible to have both devices installed in the same breaker. Both devices are interchangeable.
- In standard configuration, internal voltage converter (Code 8) transforms external voltage into 24 V DC, which is required by ST or UVR. Both devices are tripped by a potential free contact connected as shown in section 4.2.
- Optionally, ST can be connected directly to external voltage. In this case extinguish capacitors and diode is used to improve switching of the shunt trip's coil [Fig 19-4c]. Double winding shunt trip is available with this option for 110/125/220 V DC external control supply.
- Optionally, it's possible to supply both devices directly to external 24 V DC (± 5%). In this case the release signal for ST shall not be longer 100 ms.
- The ST is used for remote actuation. It is designed for short time operation with max. duty cycle of 9 %. ST's supply is connected through auxiliary contacts, which cut off supply voltage after opening. This protects ST against overheating.
- The UVR [Fig. 9] is used for remote actuation and, in combination with an internal electronic control, for voltage control.
- The UVR releases at voltage interruption or supply voltage drop below 20 V. In these cases UVR trips the breaker. It is therefore possible to use this device in combination with the electronic trip unit for voltage monitoring, where an unintended re-start of machines after a temporary voltage breakdown is to be prevented.
- The UVR is intended for continuous operation. Its rated power is 10 W.
- Due to its operational mode, the UVR is a self-monitoring device, i.e. when the breaker is tripped upon a break of the pilot wire (EMERGENCY-OFF principle).
- NOTE: Manual closing of the breaker with ST installed, while pushbutton OPEN is pressed and control power applied, might lead to ST coil's overheating and damage.

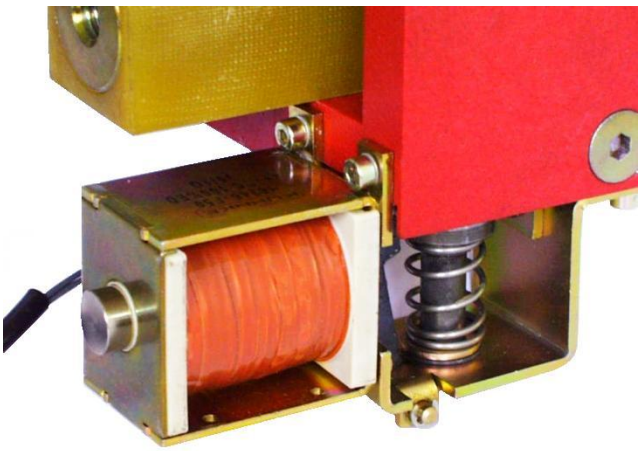


Fig. 9 Zero voltage release

3.2.7 Forced tripping release (Code 13)

- Optionally, the forced tripping release (FT) can be installed in the breaker [Fig. 10a]. This unit mechanically trips the breaker, by pressing the pin against the bottom plate. Force required to trip the breaker is about 30 N (~7 ft-lb). The tripping pin position is as on Fig. 10b.

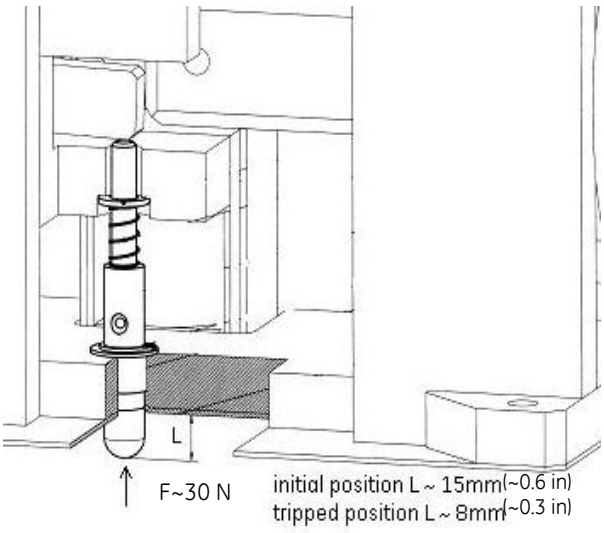


Fig. 10a Forced tripping release

- With a correctly designed interlock in an enclosure, FT provides safety-tripping function. During withdrawal operation of the trolley, the breaker is tripped BEFORE its main terminals disconnect from the mains.

Bottom view

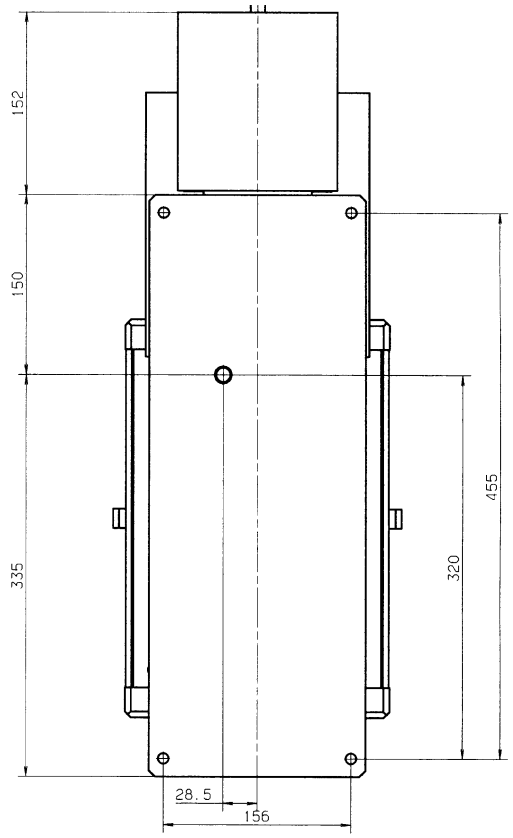
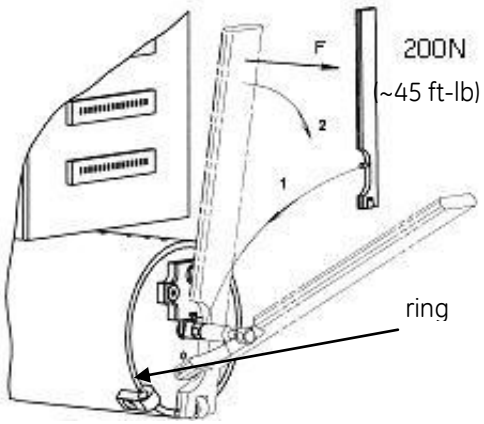


Fig. 10b Positioning of the forced tripping pin

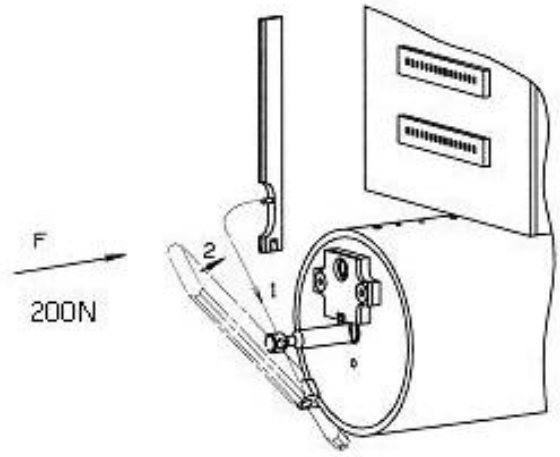
3.2.8 Lever for manual operating (Code 16)

- Optionally, a hand lever for manual closing and opening operation during maintenance is available. This tool must not be use while breaker is energized!
- To close the contacts, install hand lever on the drive's rod, and pull it out smoothly until latches snap [Fig. 11a].
- To open the contacts, install the tool into the ring and push it hard against the drive's rod until breaker opens [Fig. 11b].



WARNING: Manual closing and opening – only during maintenance!

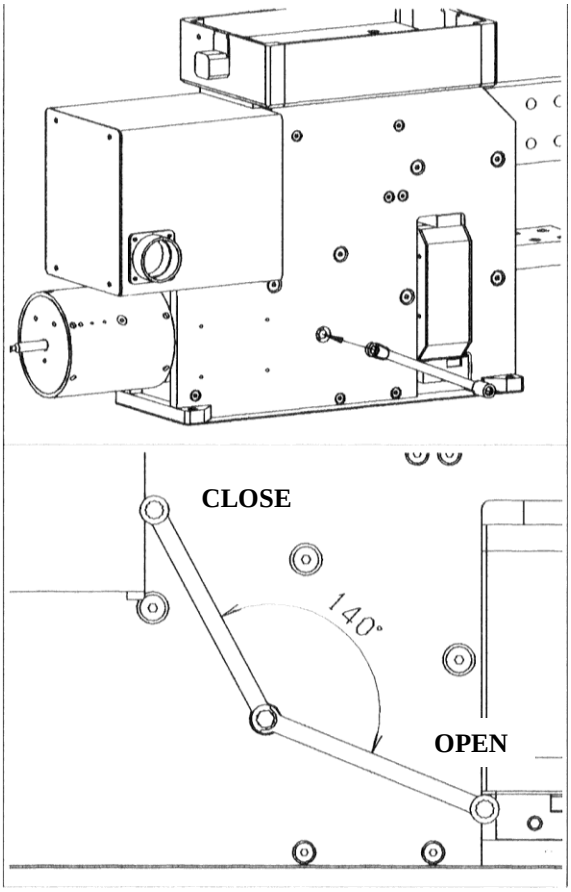
Fig. 11a Closing operation by using hand lever



WARNING: Manual closing and opening – only during maintenance!

Fig. 11b Opening operation by using hand lever

- Alternative manual closing and opening operation is possible by rotating the main shaft of the breaker mechanism, which is accessible from the side. Use 10 mm hexagon-socket wrench to OPEN/CLOSE [Fig. 11c].
- **WARNING**: Pay attention to control rotation speed of the shaft during manual opening. Impede the wrench to avoid hitting it to the ground, which may lead to a hand injury.



WARNING: Manual closing and opening – only during maintenance!

Fig. 11c ON/OFF operation by using a 10 mm wrench

3.2.9 Auxiliary switch (Code 9)

- Standard breaker can be equipped with 3, 5 or 10 isolated, form C, invertible auxiliary contacts (1 NO/NC each). The movable main arm activates the contacts.
- The contacts are wired to 15-pin control terminals: -X4 and -X5, with 5 switches to each terminal [Fig. 21].
- Conventional thermal current Ith=10 A. Maximum electrical ratings for switches are 1 A/230 V for AC15. For DC13 are 0.5 A/110 V and 0.3 A/220 V.

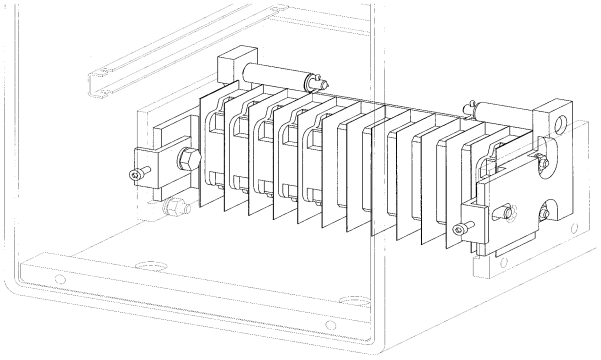


Fig. 12 Auxiliary contacts layout in control box

3.2.10 Indicators

Optionally, the circuit breaker can be equipped with following indicators:

- POSITION INDICATOR (Code 14) - mounted at the front of the closing drive. Mechanically switched by means of drive's rod. Indicates position of the main contacts.
  "O" – means contacts are open
  "I" – means contacts are closed

Fig. 13 Position indicator

- OC TRIP TARGET (Code 10) – a potential free, NO contact mounted at the top of the OCT [Fig. 14]. Provides a signal when OCT trips.

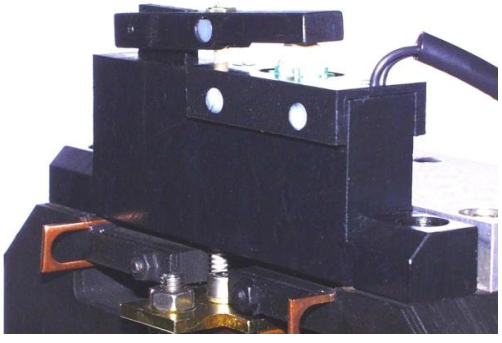


Fig. 14 OCT trip target

- ARC CHUTE INDICATOR (Code 17) – a potential free, NO contact mounted on the sidewall. Locks electrically the closing drive when arc chute is not installed on [Fig. 15].

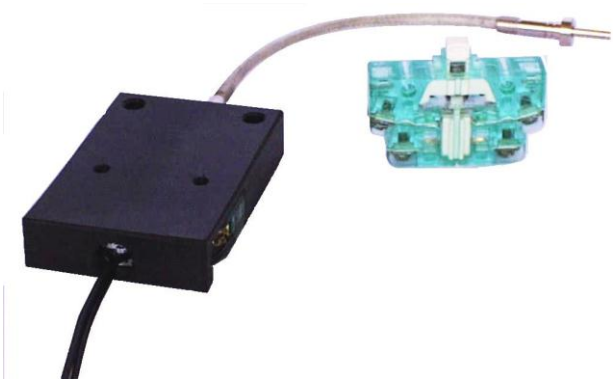


Fig. 15 Arc chute indicator

3.2.11 Solenoid closing drive (Code 3)

- A high power solenoid is used to perform fast closing operation. This drive is mounted at the front of the breaker and is encased in a grounded casing [Fig. 16].
- Closing drive is supplied independently from other controls (-X2 :1/:2), directly from external power source. Voltage level must be defined at order placement. Rated power, depends on breaker type, but is between 1.8 kW and 2.6 kW.
- CLOSING command is enable by external potential free contact at (-X2 :4/:5). Signal duration shall be ~300 ms.
- The closing drive system always includes a self-interrupt control circuit (SU PCB). This circuit enables short activation with a time of ~150 ms. SU switches power to the solenoid and automatically disconnects it after ~400 ms.
- The SU unit also prevents repeated drive closing, due to an existing and continuous short circuit conditions and provides an "anti-pumping" safety feature.

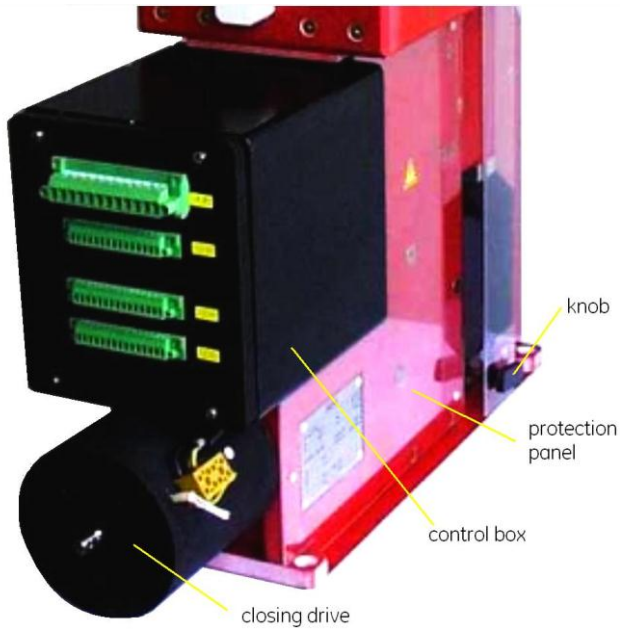


Fig. 16 Solenoid closing drive and control box

- After closing attempt, the switch-in mechanism is electrically blocked for approximately 8 sec. Lock time increases to 14 sec, if internal C-bank (NEKO) is present. This prevents premature closing following a short circuit.

3.2.12 Current measurement system (Code 6)

- The SEL current measurement system consists of the sensing component (1) and signal-processing unit (2) [Fig.17]. SEL sensor is integrated into a specially shaped upper terminal of the breaker and is connected by a shielded cable to the signal-processing unit. SEL control unit is placed in the control-box [Fig. 18].

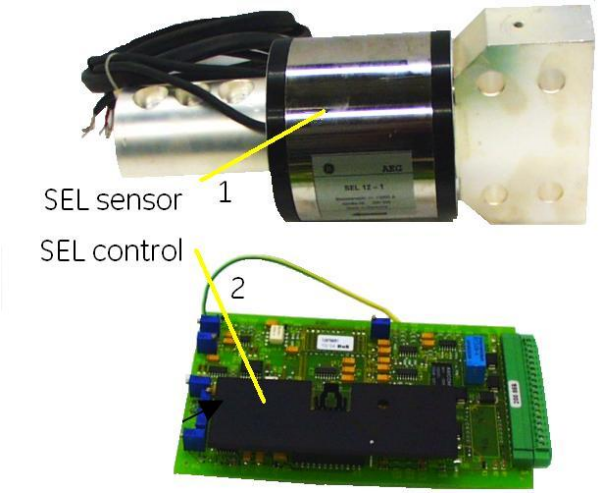


Fig. 17 SEL current measurement system

- SEL may be used for recording DC currents in selected measurement ranges of 6 kA or 12 kA. Measurement of rated current values and of the current rise may now be made directly at the breaker.
- The sensor includes Hall-probes and delivers a proportional signal-output to the SEL control. The signal-processing unit transforms input signal, into standard output signals shown in the table below.
- The outputs are insulated from the main voltage. The insulation withstands voltages up to 4 kV RMS and up to 40 kV in peak.
- Two versions are available. Standard model (T35) for ambient temperature –5 °C...+35 °C and the model for higher temperature (T55) –5 °C...+55 °C.
- More details can be found in separate instruction for SEL usage.

Type SEL	**06-1**	**06-2**	**06-4**	**12-1**	**12-2**	**12-4**
Input	- 6 kA…+6 kA			-12 kA…+12 kA		
U_{Ne} [V]	1000	2000	4000	1000	2000	4000
T35	for ambient temperature of the breaker -5 °C…+35 °C / +23 °F…+95 °F					
T55	for ambient temperature of the breaker -5 °C…+55 °C / +23 °F...+131 °F					
I_{Ne}	Relating to the rated current of the breaker					
Output	4...20 mA -20...20 mA -10...10 V					
U_{Ni} [kV]	12	18	40	12	18	40

3.2.13 Electronic control system

All the control PCBs are installed in control box [Fig. 18]. Starting from the left, these are:

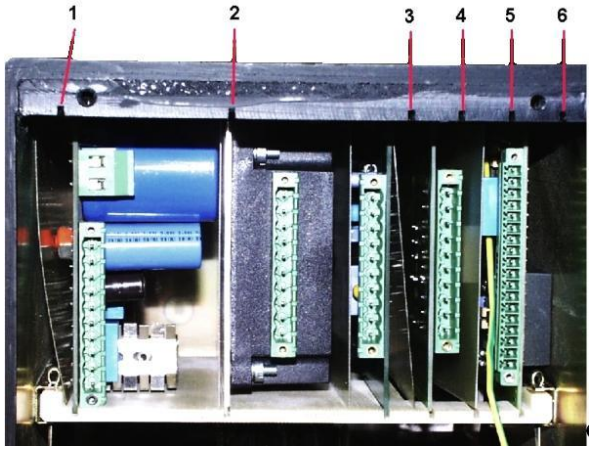


Fig. 18 Control box with control units

- **(1)** NEKO control unit [Fig. 19-1] (Code 12) – internal control unit with capacitor bank. Releases firing signal for ED coil (-X2 :10/:11) and provides indication of the capacitors charging (-X3 :6/:7). NEKO control unit also blocks the firing signal until C-bank is fully charged (~15 sec).
- **WARNING**: NEKO unit requires a high quality firing signal. Be sure, that voltage level is between 8 V...24 V DC and there are no short spikes on signal (<3 ms). This might lead to major defect of the NEKO control unit!

Fig. 19-1 NEKO control unit

- **(2)** Internal voltage converter (Code 8) - converts external supply voltage (-X3 :4/:5) to the internal 24 V DC. Required by controls (except for the drive supply).

Fig. 19-2 Voltage converter 110 V/24 V DC.

- (**3**) SU control unit – see point 3.2.11

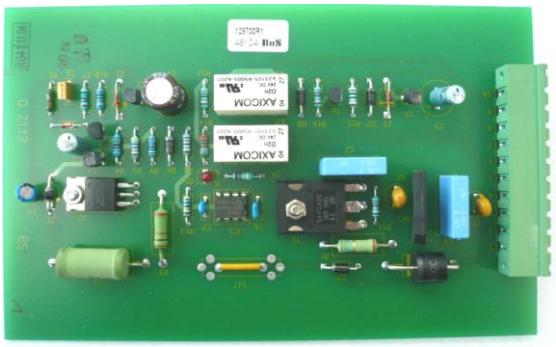


Fig. 19-3 SU control unit.

- (**4**) ST/UVR control unit – simple relay system. It controls operation of shunt trip or zero voltage release.

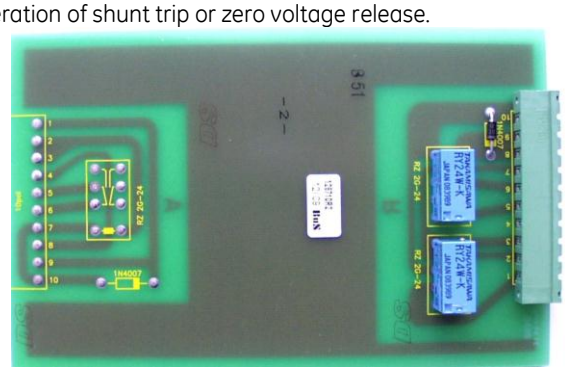


Fig. 19-4a UVR control unit

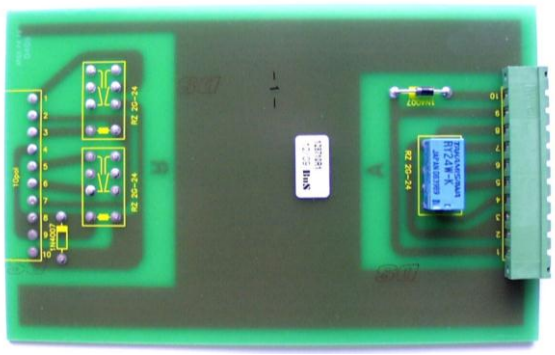


Fig. 19-4b- ST control unit

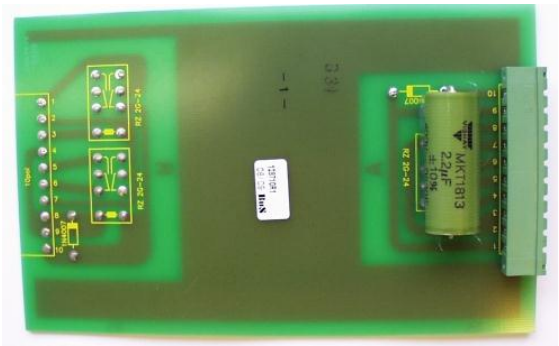


Fig. 19-4c Extinguish capacitor for direct ST supply.

- (**5**) EMPTY SLOT. – not used.
- (**6**) SEL control unit – see point 3.2.12

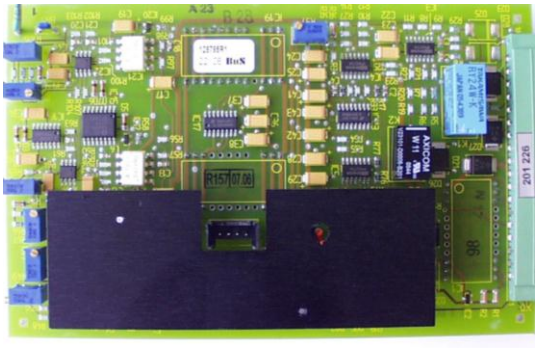


Fig. 19-6a SEL control unit (T 35)

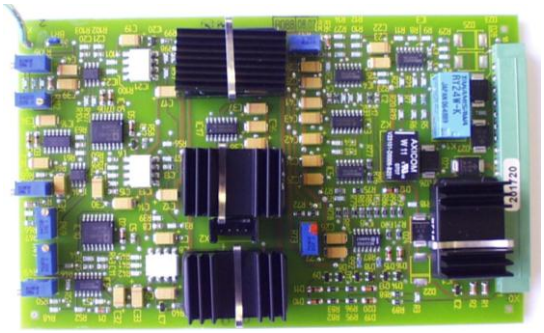


Fig. 19-6b SEL control unit (T 55)

3.3 Technical data tables

Breaker type	**Gerapid 2607**					**Gerapid 4207**					**Gerapid 6007**					**Gerapid 8007**	
Arc chute type	1X2	1X4	2X2	2X3	2X4	1X2	1X4	2X2	2X3	2X4	1X2	1X4	2X2	2X3	2X4	1X2	2X2
Conventional thermal current I_{th} [A] (IEC/EN)	2600					4200					6000					8000	
Rated current [A] (ANSI/IEEE C37.14)	2600					4150					-1)					6000	
Rated voltage U_e [V]	1000	2000	2000	3000	3600	1000	2000	2000	3000	3600	1000	2000	2000	3000	3600	1000	2000
Rated insulation voltage U_i [V]	2000	2000	2000	3000	4000	2000	2000	2000	3000	4000	1000	2000	2000	3000	4000	1000	2000
Short time current 120 min [A]	3150					5000					7200					9600	
Short time current 2 min [A]	5200					8500					12000					16000	
Short time current 20 sec [A]	7800					12600					18000					24000	
Impulse withstand voltage 1,2/50 µs Ui [kV] according to EN 50124-1:1997	18	18	18	30	30	18	18	18	30	30	12	18	18	30	-1)	12	18
Power frequency withstand voltage 50 Hz Ua [kVeff] according to EN 50124-1:1997	10	10	10	15	15	10	10	10	15	15	7	10	10	15	-1)	7	10
Rated short circuit making capacity $\hat{I}_{Nss}$ [kA]	70	50	100	50	42	70	50	100	50	42	70	50	80	50	-1)	70	- 1)
Rated short circuit breaking capacity I_{Nss} [kA] according to EN 50123-2	50	35	71	35	30	50	35	71	35	30	50	35	56	35	-1)	50	50
Rated service short circuit breaking current Ics [kA] according to IEC 947-2	60	40	50	40	40	60	40	50	40	40	60	40	50	40	-1)	60	- 1)
Short circuit current according to IEEE C37.14 [kA]	120		-1)			120		60					-1)			120	-1)
Peak current according to IEEE C37.14 [kA]	200		-1)			200		100					-1)			200	-1)
Maximum short circuit current [kA] tested at customer request	244	120	100		52	244	120	100		52	200					240	
Maximum arc voltage Uarc [kV]	2	4	4	5,6	7	2	4	4	5,6	7	2	4	4	5,6	7	2	4
Weight ca. [kg]	120	120	160	160	160	120	120	160	160	160	150	150	165	165	165	190	210
Weight ca. [lbs]	265	265	352	352	352	265	265	352	352	352	331	331	364	364	364	419	463

1) Rating tests at customer request

Table 1: Technical data of Gerapid 2607, 4207, 6007, 8007.

Control box terminals	1x12-pole 4x15-pole		AC 400 V, 20 A AC 250 V, 8 A
Closing solenoid drive[1)]	Rated voltage Operating range Power consumption Gerapid 2607 / 4207 Power consumption Gerapid 6007 / 8007 Minimal CLOSING command duration min.interval between two "CLOSE" operations		AC 48 V - 230 V and DC 48 V - 220 V 80 % - 115 % of rated voltage 1750 W / 2000 W 2600 W / 2600 W 100 ms ~8 s w/o NEKO installed; ~14 s with NEKO
Internal voltage converter [1)] **for Gerapid 2607, 4207, 6007, 8007**	Input: Voltage range Output: Voltage range Current Model description		DC 33 - 85 V DC 24 V (±5%) 6 A permanent PCMD 150 48 S24W-GE
	Input: Voltage range Output: Voltage range Current Model description		DC 88 - 145 V DC 24 V (±5%) 6 A permanent PCMD 150 110 S24W-GE
	Input: Voltage range Output: Voltage range Current Model description		AC 115 - 240 V, DC 125 - 353 V DC 24 V (±5%) 3 A permanent, 5 A/100 ms PCMA 70 S24W-GE
External power supply	with plug and socket unit		requires extrnal 24 V (±5%) DC
Aux. contact HS 1...HS 10, **OC trip target (code 10)** **Arc chutes indicator (code 17)**	Rated operational voltage Rated operational current Conventional thermal current Rated operational voltage Rated operational current Minimum current/voltage ratings Contact duty (min. value)	Ue/AC Ie/AC-15 Ie/AC-12 (Ith) Ue/DC Ie/DC-13	230 V 1 A 10 A 110 V / 220 V 0.5 A / 0.3 A 0,1 mA / 6 V DC DC 10 V / 2 mA
Shunt trip standard	Rated voltage/power Operating range: OFF	Uc/Pc	24 V / 100 W 21.6 V - 26.4 V
Shunt trip double winded	Rated voltage/power Rated power for a single winding	Uc Pc	DC 110 V/ DC 125 V/ DC 220 V 230 W
UVR (Zero voltage release)	Rated voltage Operating range: OFF Operating range: ON Power consumption	Uc	24 V < 4 V 24 V (±10%) ~ 10 W
ED impulse release	Energie source: Capacity Charging voltage Switching interval Endurance Firing signal level / duration Charging signalization relay	AC duty : DC duty :	2000 µF 300 V max. 2/min with 10 consecutive operations 1 000 operations with 1 operation per 180 s 8 - 24 V / 100 - 1000 ms AC 250 V/ 0.5 A - AC 120 V /1 A DC 220V/0.1A - DC 125V/0.3A - DC 10V/3A

[1)] Standard ambient conditions acc. to EN 50123-1 Attachement B. For meeting outside of this standard range, please call back.

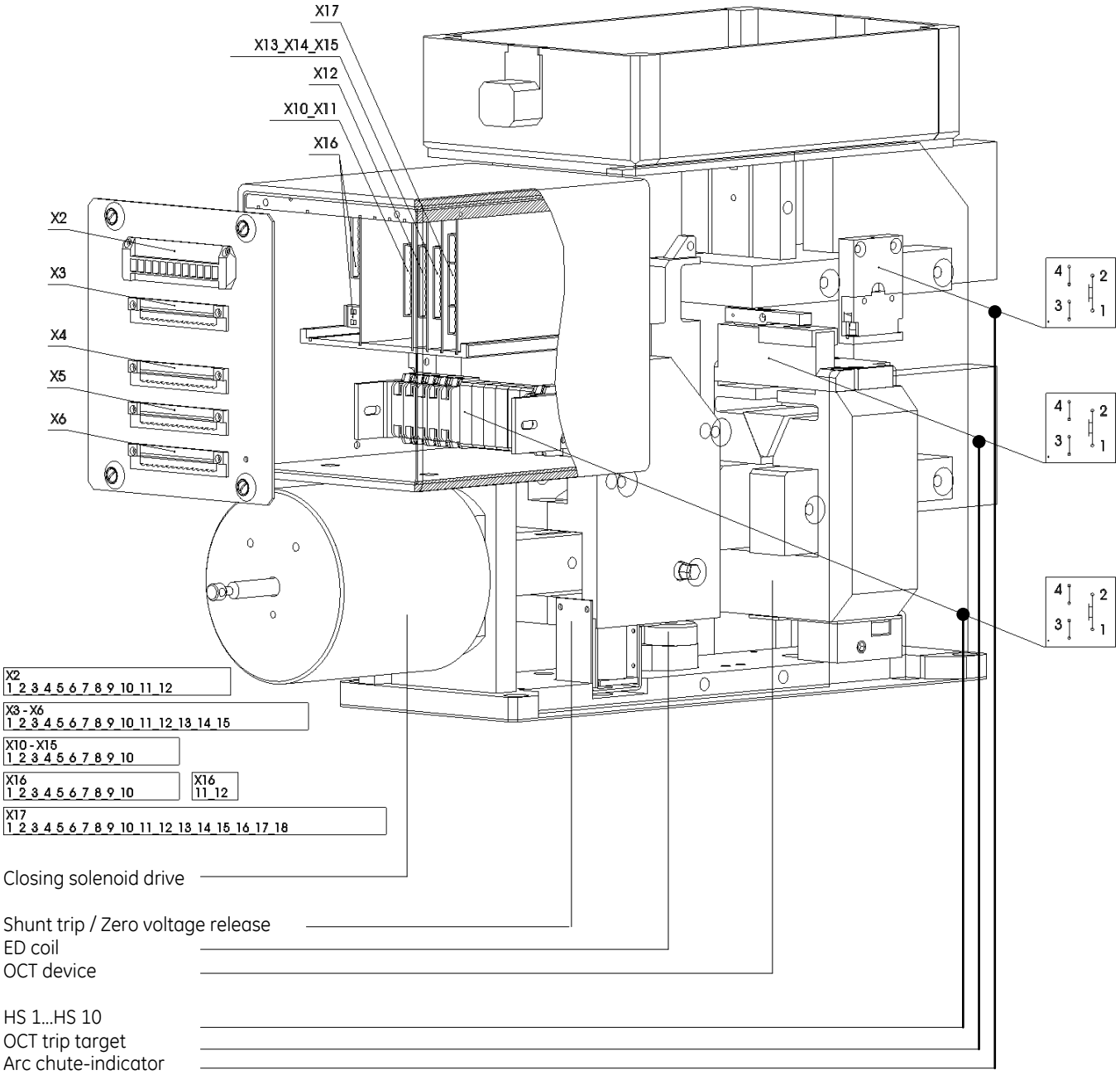
Table 2a: Technical data of auxiliary circuits

Components		*Technical datas of control circuits* *Us / In*
SU-Control	*CLOSE-push-button -S1*	*DC 24 V / approx. 10 mA*
ST releasing	*push-button-S2*	*DC 24 V / approx. 4 A*
UVR releasing	*push-button -S2 (-X2 :6 / :7)*	*DC 24 V / approx. 10 mA*
	push-button -S2 (-X2 :8 / :9)	*DC 24 V / approx. 450 mA*
ED-coil tripping w/o NEKO	*push-button -S3*	*DC 300 V / 750 A / 3 ms*
ED-coil tripping with NEKO	*Connect "Firing signal" at (-X2 :10 / :11)*	*DC 8 V...24 V / approx.20 mA*

Table 2b: Control circuits (directional values to rate the components)

4. Electrical circuits

4.1 Controls layout



Description	Designation
X2	1.Connector: Auxiliary- and control circuits
X3	2.Connector: Auxiliary- and control circuits
X4	3.Connector: Auxiliary contacts HS1...HS5
X5	4.Connector: Auxiliary contacts HS6...HS10
X6	5.Connector: Current measure system SEL
X10	Control board: Voltage converter
X11	Control board: Interface for external DC 24V supply (OPTION)
X12	Control board: SU control unit
X13	Control board: Shunt trip control unit
X14	Control board: Zero voltage release
X16	Control board: NEKO control unit for ED coil control
X17	Control board: Current measure system SEL

Fig. 20 Control system's layout

4.2 Terminals wiring system

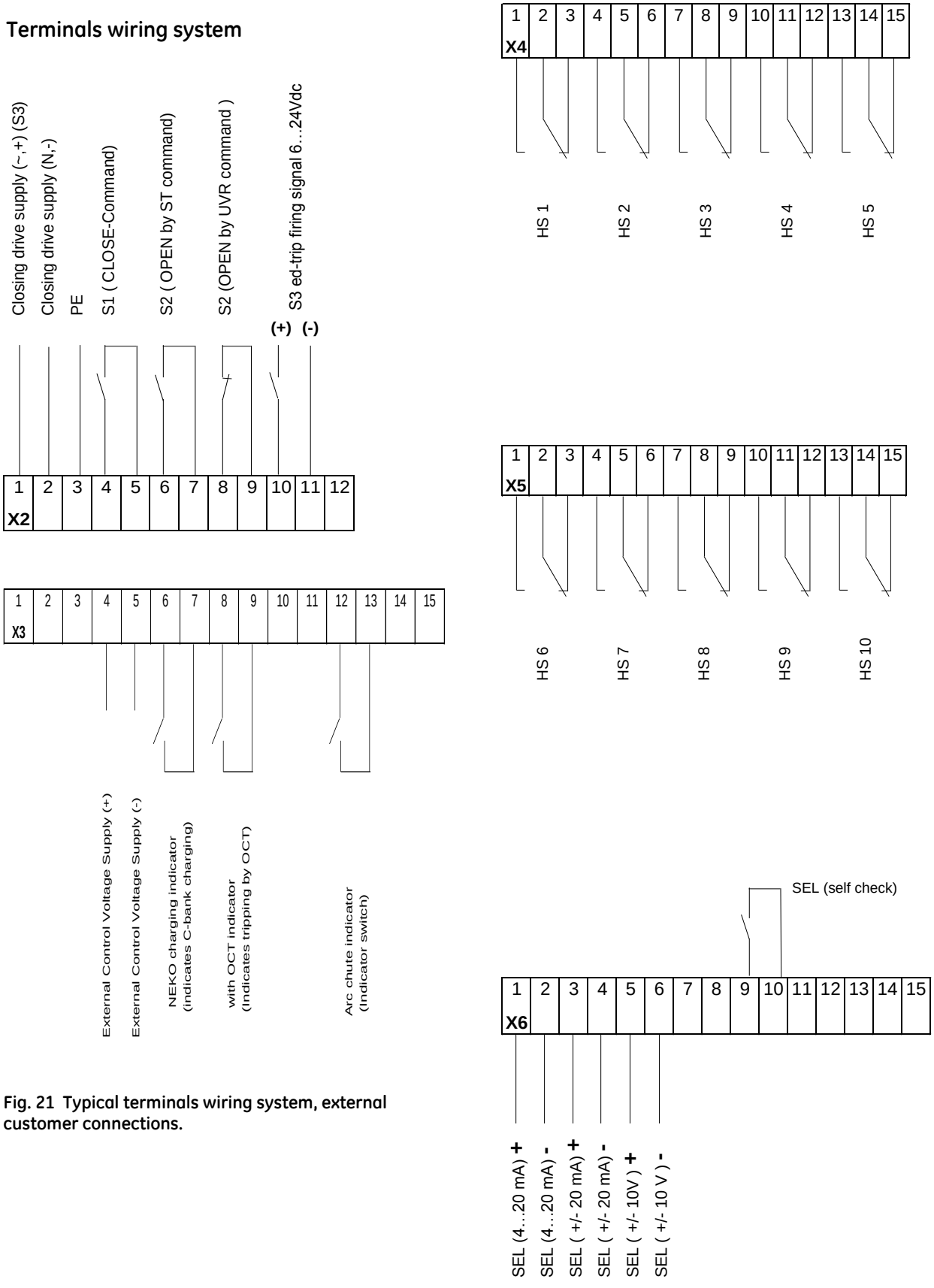


Fig. 21 Typical terminals wiring system, external customer connections.

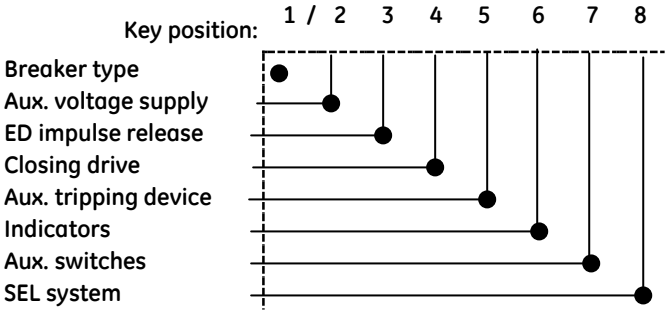
4.3 Electrical diagrams

4.3.1 Wiring code

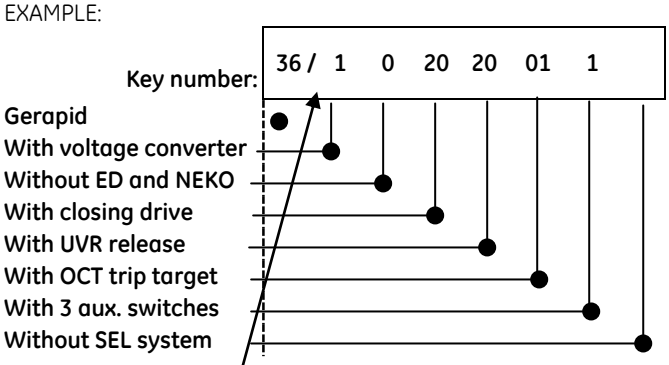
- The main circuits are not shown in the wiring diagrams for transparency. The control circuit is presented as a typical circuit diagram and is a combination of numbered basic diagrams for drives, trips and indicators.
- Using the key numbers of the basic plan, you can derive the number of the complete diagram.

- WARNING: Some non standard electrical circuits do not comply with the diagrams in this instruction. Such circuits are coded with unique numbers i.e 36/0033. In such a case an appendix to this instruction is delivered, which contains relevant electrical diagrams.

Coding positions:



EXAMPLE:



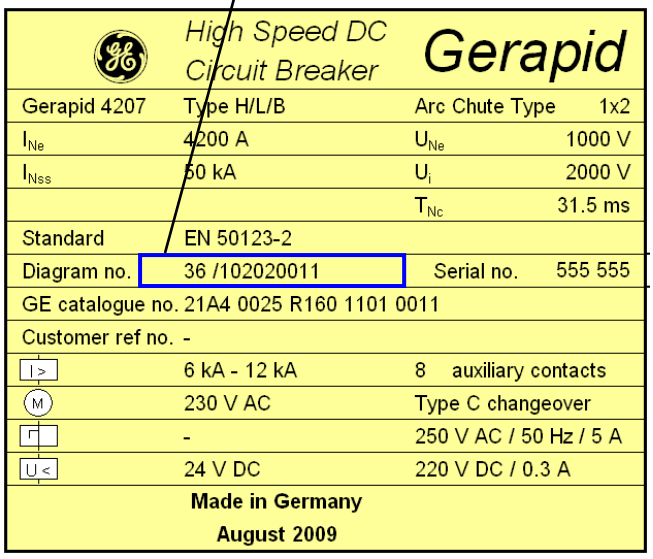

High Speed DC Circuit Breaker
Gerapid
Gerapid 4207
Type H/L/B
Arc Chute Type 1x2
I_{Ne} 4200 A
U_{Ne} 1000 V
I_{Nss} 50 kA
U_i 2000 V
T_{Nc} 31.5 ms
Standard EN 50123-2
Diagram no. 36 /102020011
Serial no. 555 555
GE catalogue no. 21A4 0025 R160 1101 0011
Customer ref no. -
I > 6 kA - 12 kA
8 auxiliary contacts
M 230 V AC
Type C changeover
- 250 V AC / 50 Hz / 5 A
U < 24 V DC
220 V DC / 0.3 A
Made in Germany
August 2009

Fig. 22 Example code shown on the nameplate.

Key position	Key number	Designation
Type		
1	36	Gerapid
Auxiliary voltage		
2	1	Voltage converter
	2	DC 24 V external supply
Tripping coil		
3	0	Without ed-trip coil
	1	With ed-trip coil
	2	With ed-trip coil and NEKO control unit
Drive		
4	20	Solenoid drive with SU control unit
Tripping device		
5	00	Without trip unit
	10	With shunt trip
	20	With zero voltage release
Indication device		
6	00	Without indicators
	01	OCT trip target
	02	Arc chute indicator
	03	OCT + arc chute indicator
Auxiliary contacts		
7	1	3 auxiliary contacts
	2	5 auxiliary contacts
	3	10 auxiliary contacts
Current-measurement system		
8	S	with SEL

Indication of components

Q1 **Impulse ED coil**
Q2 **Closing drive coil**
S1 **Push button „CLOSE“**
S2 **Push button „OPEN“, type NO**
S3 **Push button "OPEN", type NC**

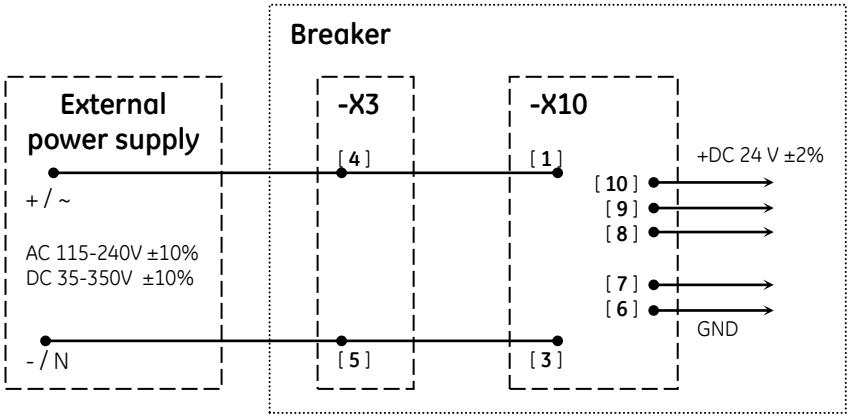
SU control PCB:
K1 **Closing relay**
K2 **Internal closing stop relay** [1)]

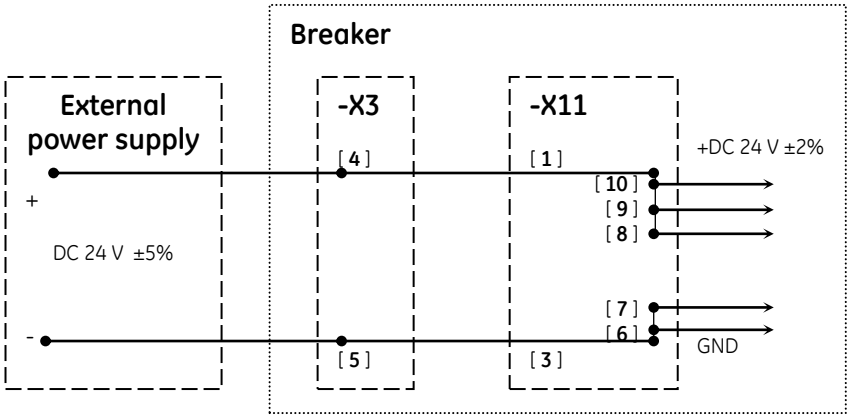
Shunt trip, zero voltage release PCB:
K1 **Internal closing stop relay** [1)]
K2 **Tripping relay**
HS11 **Shunt trip self cut-off auxiliary contact**

ED-tripping device with internal NEKO PCB:
K1 **Voltage monitoring relay**
K2 **Internal closing stop relay** [1)]

1) These relays are part of internal closing stop circuit. It is a 24 V DC closed circuit, through all PCBs in the box, except SEL. Serial connection of all relays is realized through connections (:5/:6) in each PCB. This circuit provides priority of a tripping signal over a closing signal. Additionally it prevents from closing the internal supply 24 V DC lost at UVR PCB or NEKO PCB.

4.3.2 Controls supply circuit





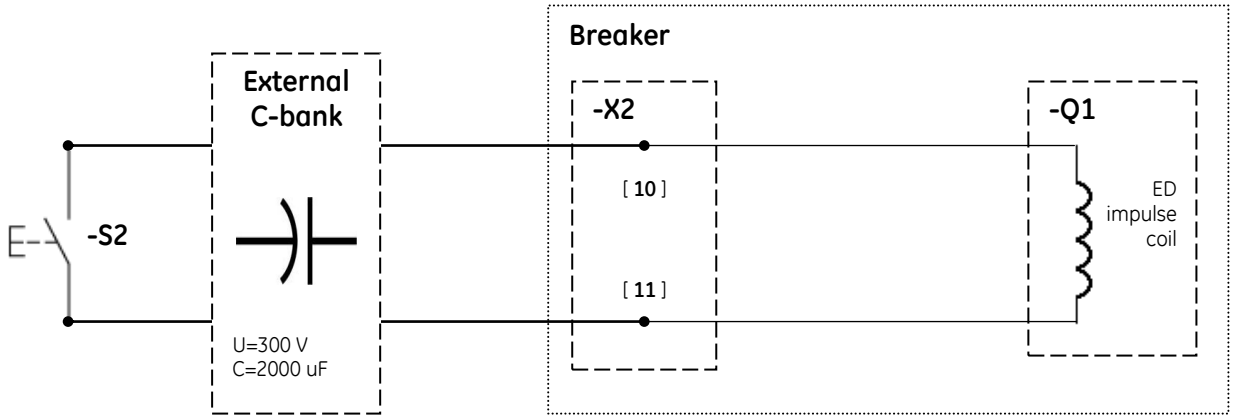
36/ X_ _ _ _ _

Key position - 2
Key number – 1: Voltage converter DC 35-85 V ; DC 88-145 V ; DC 125-353 V ;AC 115-240 V
Key number – 2: Interface for direct external voltage DC 24 V +/- 5% connection.

Fig. 23 Supply with voltage converter or with direct external 24 V DC ±5%.

4.3.3 ED coil with external capacity bank

- In this option customer provides his own solution for releasing of the ED coil, by means of external capacitor trip device. The NEKO control unit is not furnished, and coil is connected directly to front panel of control box (-X2 :10/:11).



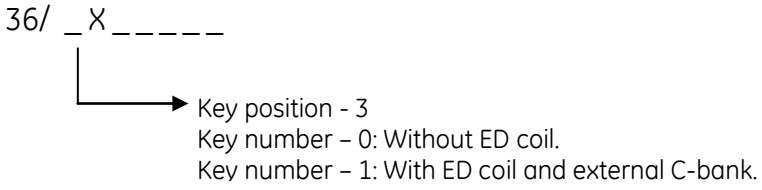
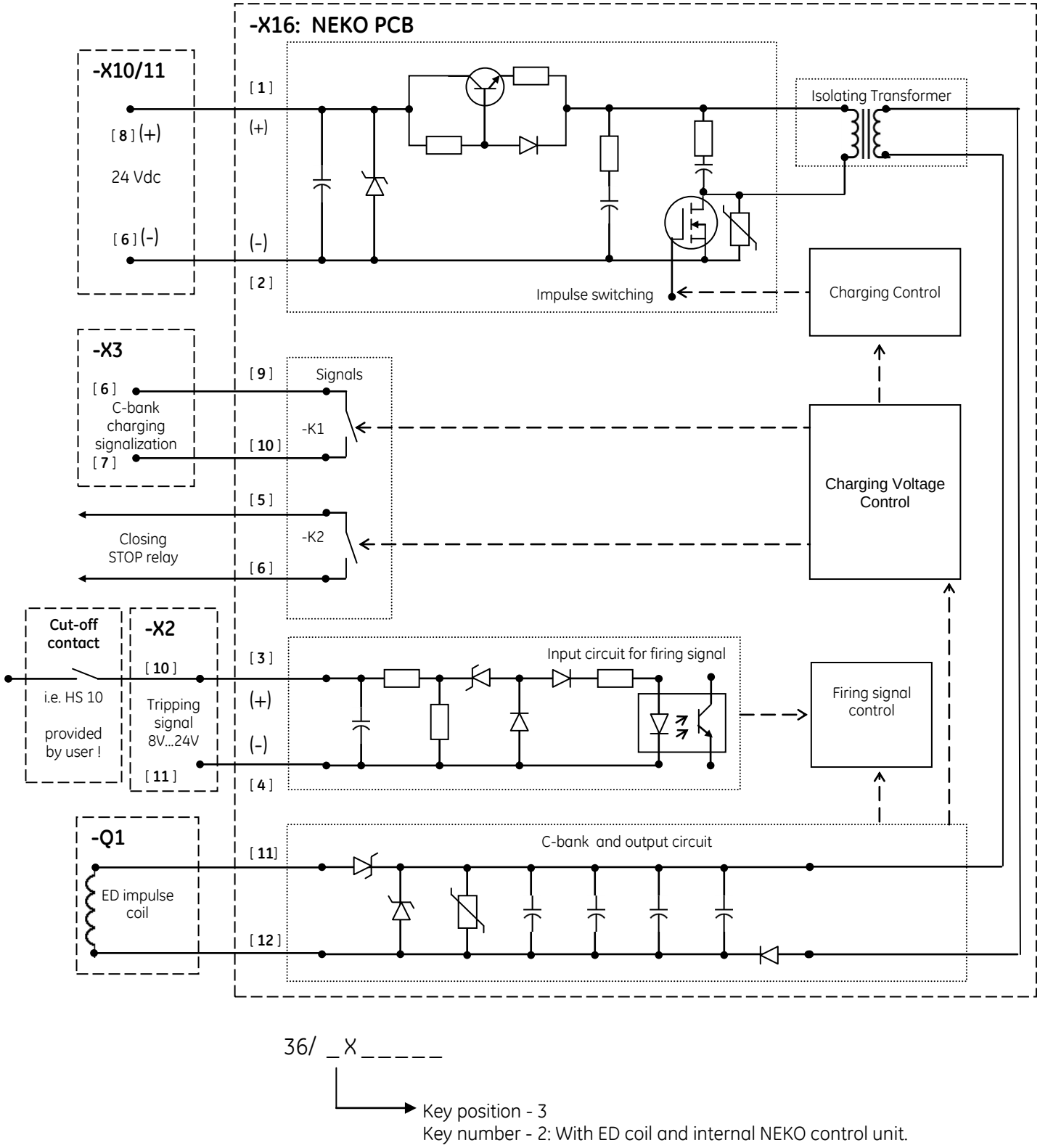


Fig. 24 ED coil with external Capacitor trip device

4.3.4 NEKO control circuit



36/ _X_ _ _ _ _

Key position - 3
Key number - 2: With ED coil and internal NEKO control unit.

- Firing signal at (-X2 :10/:11) is processed by opto-coupler. Pay attention to the polarity!
- Closing STOP signal is provided to lock CLOSE command, until capacitors are fully charged.
- Be sure that voltage level is between DC 8 V - 24 V and there are no transient spikes (<3 ms) on firing signal. This can lead to major defect of the NEKO control unit!
- Maximum duration of the firing command must not exceed ~1 sec. Longer signal might cause NEKO failure! It is recommended to use one of HS auxiliary contacts connected in series with firing circuit (-X2 :10). It will automatically cut off the firing circuit after breaker opening.

Fig. 25 ED coil with internal NEKO control unit

4.3.5 SU control circuit

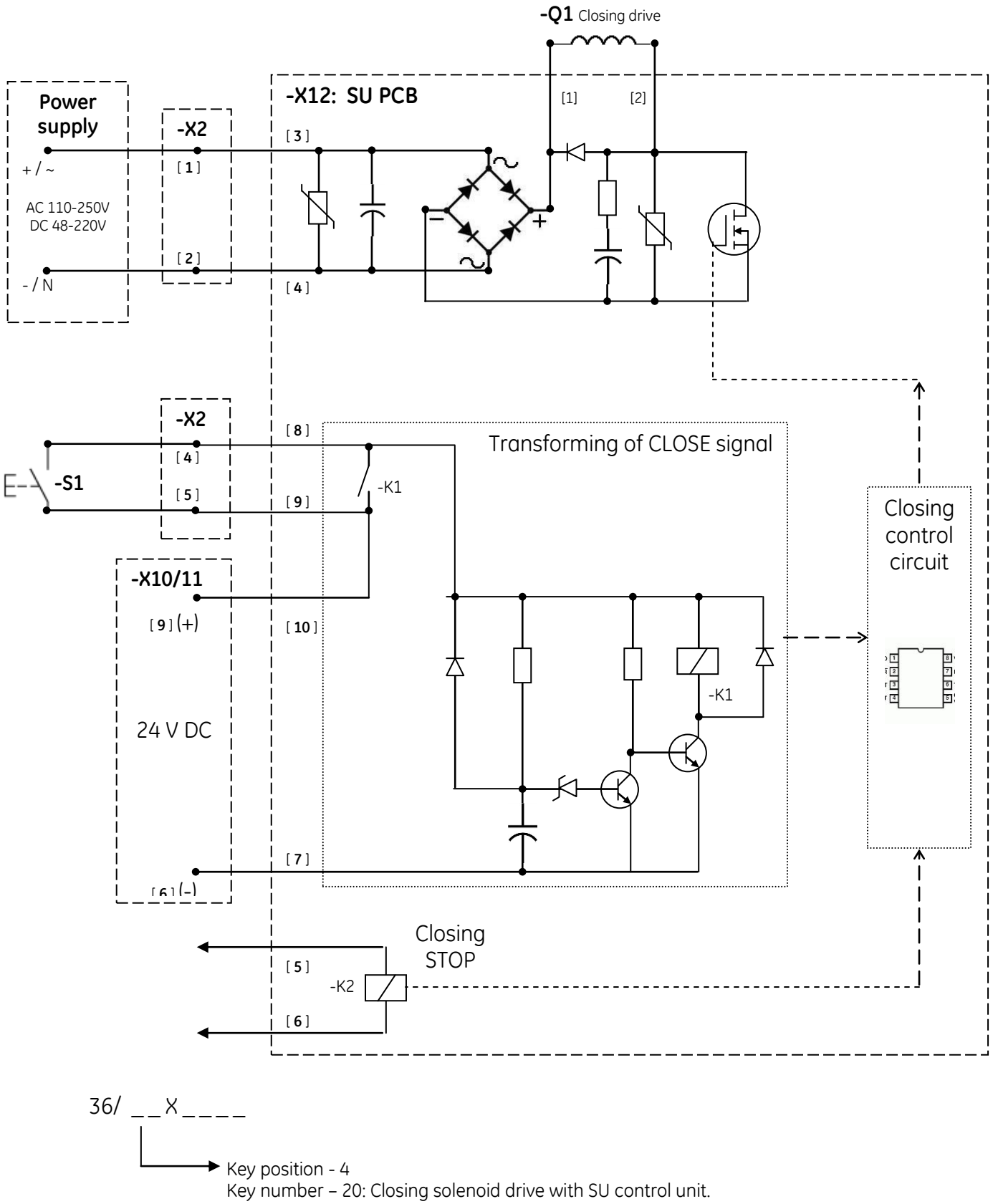
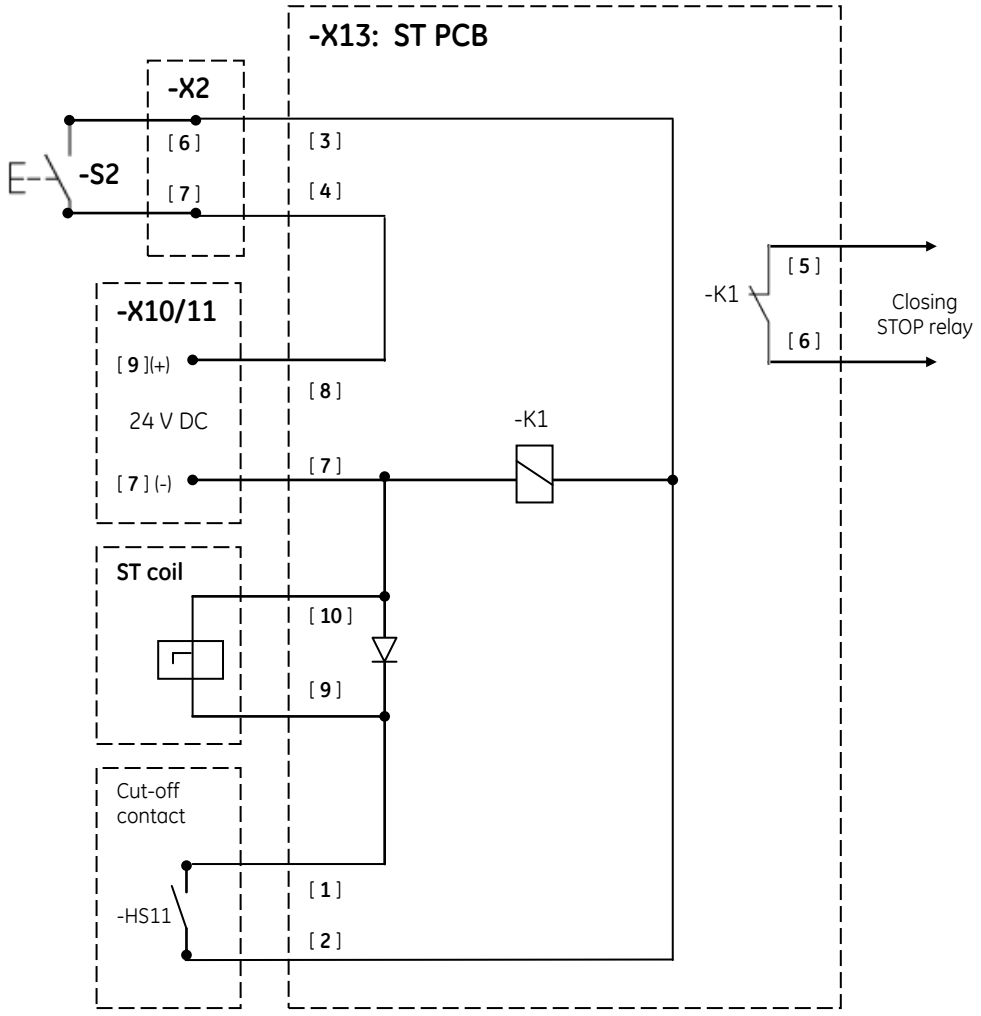
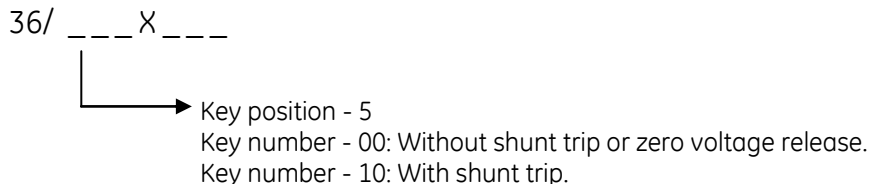


Fig. 26 SU-control circuit

4.3.6 Shunt trip control circuit

Standard DC 24 V shunt trip with control PCB.

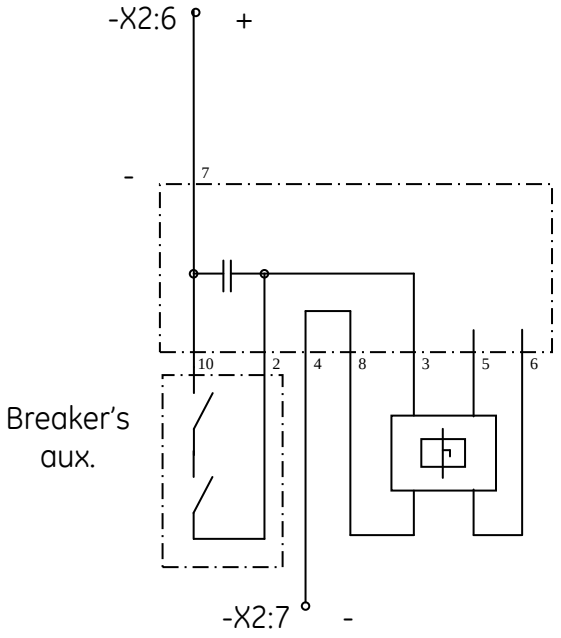




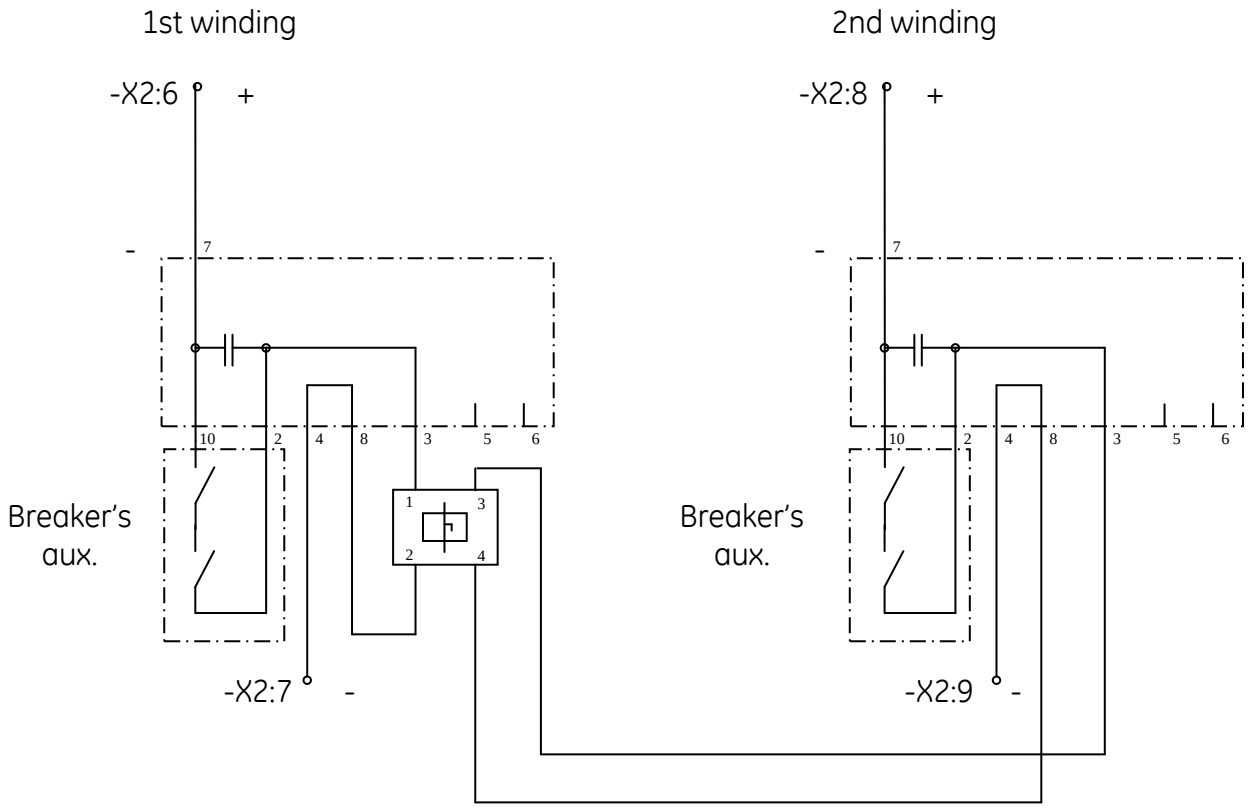
- The closing STOP signal is provided for resetting K2 on the SU-control circuit. It effects with priority in switching OFF (by ST or UVR) before switching ON. Once switching ON and OFF signals are simultaneous, switching OFF command will stay longer than switching ON. It means, that OFF command is master command.
- The shunt trip operates for short time period only. After main contacts open, switch HS 11 cuts off shunt trip coil.
- Manual closing of the breaker, while –S2 contact is closed, leads to overheating of ST coil and will damage coil.

Fig. 27a ST control circuit

- Below, non-standard shunt trip with single winding, directly supplied from external DC voltage.



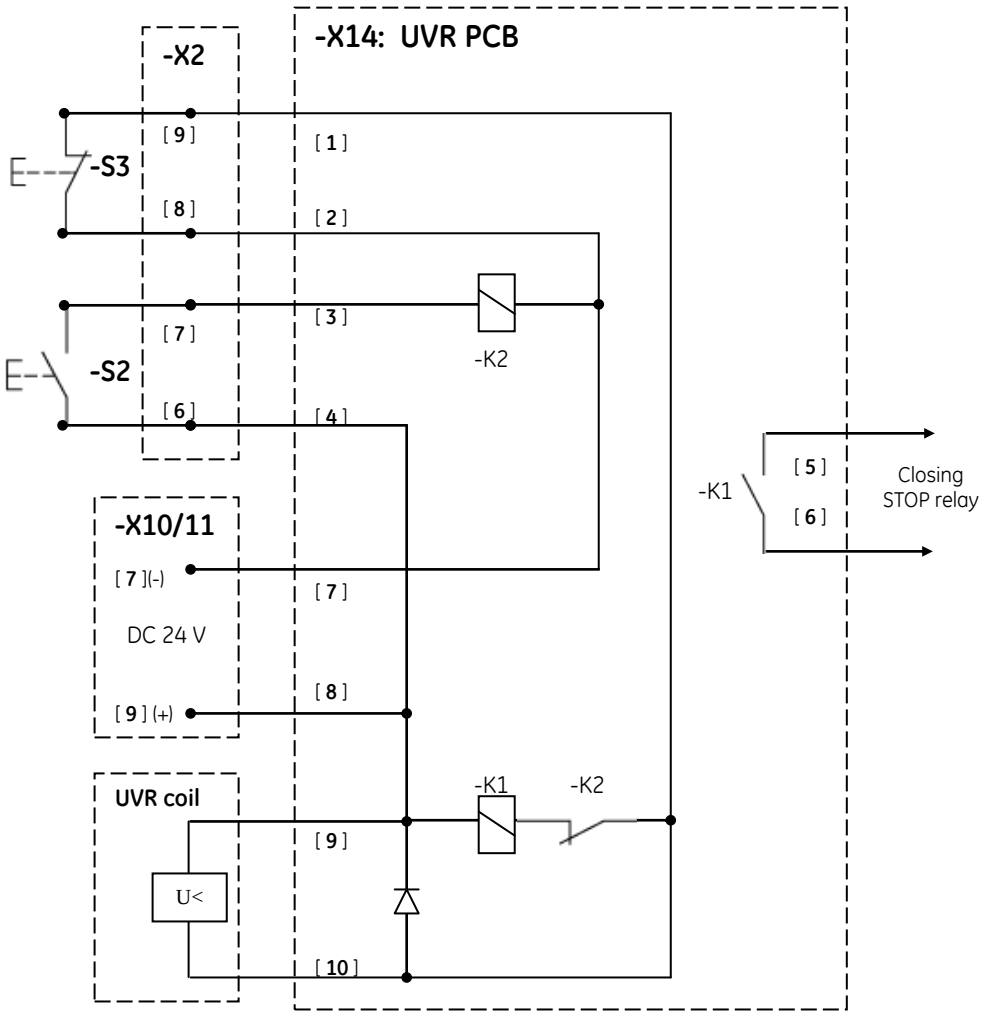
- Below, non-standard shunt trip with double winding, directly supplied from external DC voltage.



- Double winding shunt trip coil is available for external DC 110 V, DC 125 V and DC 220 V.
- User shall provide fused means for safe switching the voltage to the coil. See table 2a for coil parameters.
- Auxiliary contacts used for cutting off shunt trip coils are internal breaker's components.

Fig. 27b Special versions of shunt trip with a single and double winding coils, directly supplied from external DC source.

4.3.7 Zero voltage release control circuit



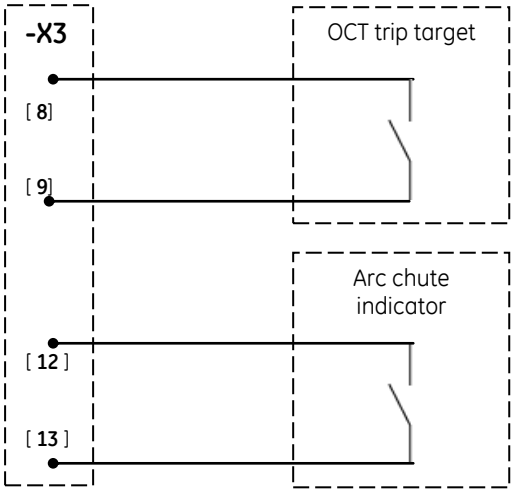
36/ _ _ _ X _ _ _

Key position - 5
Key number - 00: Without shunt trip or zero voltage release.
Key number - 20: With zero voltage release.

- The closing STOP signal is provided for resetting K2 on the SU-control circuit. It effects with priority in switching OFF (by ST or UVR) before switching ON. Once switching ON and OFF signals are simultaneous, switching OFF command will stay longer than switching ON. It means, that OFF command is master command.
- -S2 (-X2 :6/:7) is NO contact, utilized for indirect releasing of the UVR by relay -K2
- -S2 (-X2 :8/:9) is NC contact utilized for direct releasing of the UVR. If it's not used, please short this connection permanently.

Fig. 28 UVR control circuit

4.3.8 Indicators

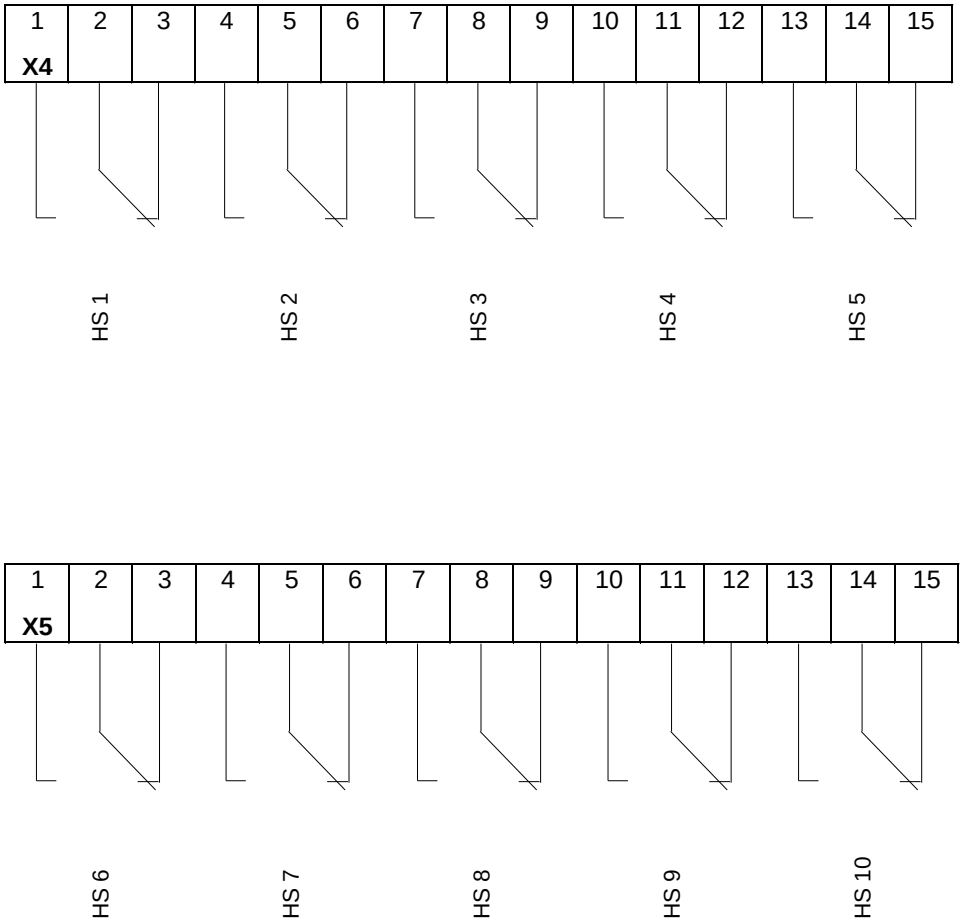


36/ _ _ _ _ X _ _

Key position - 6
Key number - 00: Without indicators.
Key number - 01: With OCT trip target only.
Key number - 02: With arc chute indicator only.
Key number - 03: With OCT trip target and arc chute indicator.

Fig. 29 OCT trip target and arc chute indicator

4.3.9 Auxiliary switch

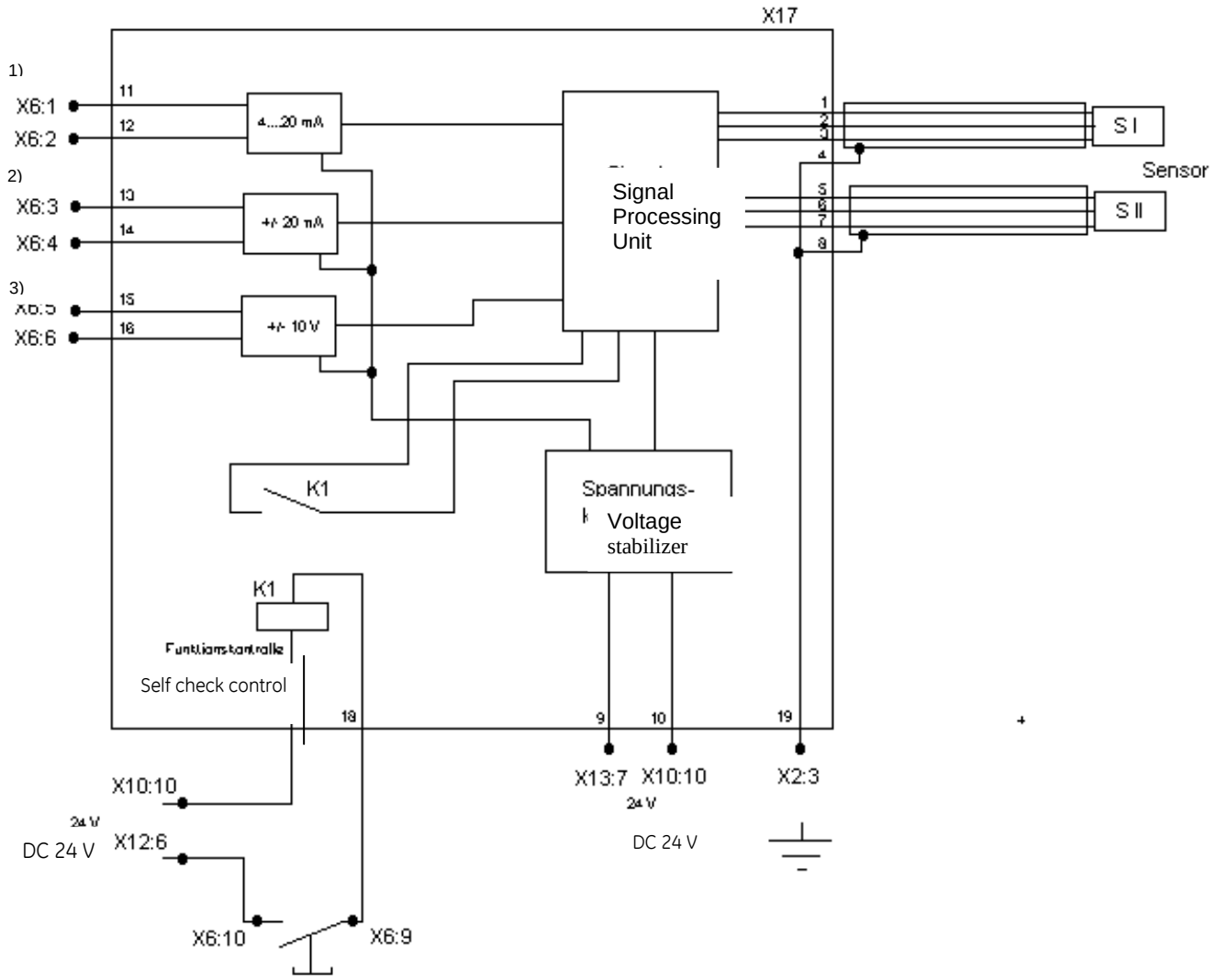


36/ _ _ _ _ _ X _

Key position - 7
Key number - 1: With 3 switches (HS1 thru HS3).
Key number - 2: With 5 switches (HS1 thru HS5).
Key number - 3: With 10 switches (HS1 thru HS10).

Fig. 30 Auxiliary switch

4.3.10 SEL measuring system



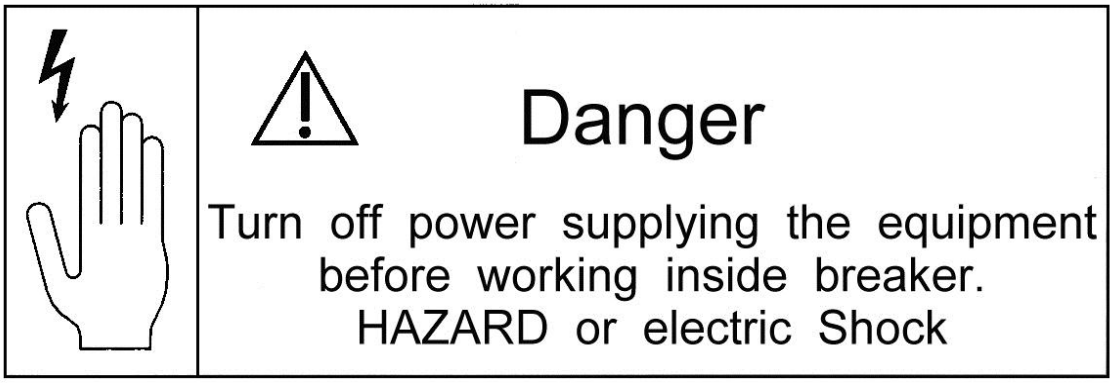
1) max. 500 Ω 2) max. 500 Ω 3) min. 300 kΩ

36/ _ _ _ _ _ _ X

Key position - 8
Key number - S: With SEL measurement system.

Fig. 31 SEL current measurement system

Warnings



During operation, all metallic parts of the breaker, except control box and closing solenoid drive, may carry dangerous voltages.

Insulation covers are available as an option.

For installation of the breaker into cubicle, top and side openings shall be provided, in order to reduce internal pressure rise during clearing short circuit.

Ventilation openings in the breaker cubicle top cover shall not be less than 50% of total surface area.

5.1 Safety distances.

Units call in mm (inches)

Type Gerapid	Arc chute	Main-Connection	Additional isolation	Deflector	Safety distances / Insulated plates				Safety distances / Earthed plates			
				E	A	B	C	D	A	B	C	D
2607 / 4207	1x2	*all*		10 (0,4)	700 (27,6)	150 (5,9)	150 (5,9)	120 (4,7)	1000 (39,4)	300 (11,8)	300 (11,8)	300 (11,8)
	1x3	*all*		1)	1)	1)	1)	1)	-	-	-	-
	1x4	*all*		150 (5,9)	700 (27,6)	150 (5,9)	150 (5,9)	120 (4,7)	1350 (53,2)	450 (17,7)	450 (17,7)	200 (7,9)
	2x2	*all*		80 (3,15)	1000 (39,4)	180 (7,1)	180 (7,1)	180 (7,1)	1350 (53,2)	450 (17,7)	450 (17,7)	300 (11,8)
	2x3	*all*		80 (3,15)	1000 (39,4)	180 (7,1)	180 (7,1)	180 (7,1)	-	-	-	-
	2x4	*H / H*	*Plate*	150 (5,9)	1000 (39,4)	180 (7,1)	180 (7,1)	180 (7,1)	-	-	-	-
	2x4	*H / H*	*Sidewalls*	150 (5,9)	1000 (39,4)	180 (7,1)	180 (7,1)	180 (7,1)	-	-	-	-
	2x4	*SEL / H*	*Pan*	150 (5,9)	1000 (39,4)	180 (7,1)	180 (7,1)	180 (7,1)	-	-	-	-
6007	1x2	*V / V Heat sink*		10 (0,4)	1000 (39,4)	300 (11,8)	300 (11,8)	180 (7,1)	-	-	-	-
	1x3	*1)*	*1)*	1)	1)	1)	1)	1)	-	-	-	-
	1x4	*V / V Heat sink*		150 (5,9)	1000 (39,4)	300 (11,8)	300 (11,8)	180 (7,1)	-	-	-	-
	2x2	*V / V Heat sink*		80 (3,15)	1000 (39,4)	180 (7,1)	180 (7,1)	180 (7,1)	-	-	-	-
	2x3	*V / V Heat sink*		80 (3,15)	1000 (39,4)	180 (7,1)	180 (7,1)	180 (7,1)	-	-	-	-
	2x4	*1)*	*1)*	1)	1)	1)	1)	1)	-	-	-	-
8007	1x2	*V / V Heat sink*		10 (0,4)	1000 (39,4)	300 (11,8)	300 (11,8)	180 (7,1)	-	-	-	-
	1x3	*1)*	*1)*	1)	1)	1)	1)	1)	-	-	-	-
	1x4	*1)*	*1)*	1)	1)	1)	1)	1)	-	-	-	-
2)	2x2	*V / V Heat sink*		80 (3,15)	1000 (39,4)	180 (7,1)	180 (7,1)	180 (7,1)	-	-	-	-
2)	2x3	*V / V Heat sink*		80 (3,15)	1000 (39,4)	180 (7,1)	180 (7,1)	300 (11,8)	-	-	-	-
	2x4	*1)*	*1)*	1)	1)	1)	1)	1)	-	-	-	-

[1] will be checked by customers order [2] acc. IEC 947-2 / ks-setting <12 kA **H**...Horizontal terminal **V**...Vertical terminal **SEL**...Current measurement system type SEL

Legend for dimensional drawings

K	Heat sink (for Gerapid 6007)
L	All openings respectively free areas on the top of the cubical shall be not less than 50%
M	Solenoid drive
P	Diameter 9 mm [0,35 in], Countersunk screw M8
S	Control box
Z	Connector

5.2 Outlined dimensions

5.2.1 Gerapid 2607,4207, 6007 with arc chute 1x_

Pay attention to legend, warnings and safety distances pages 26/27!

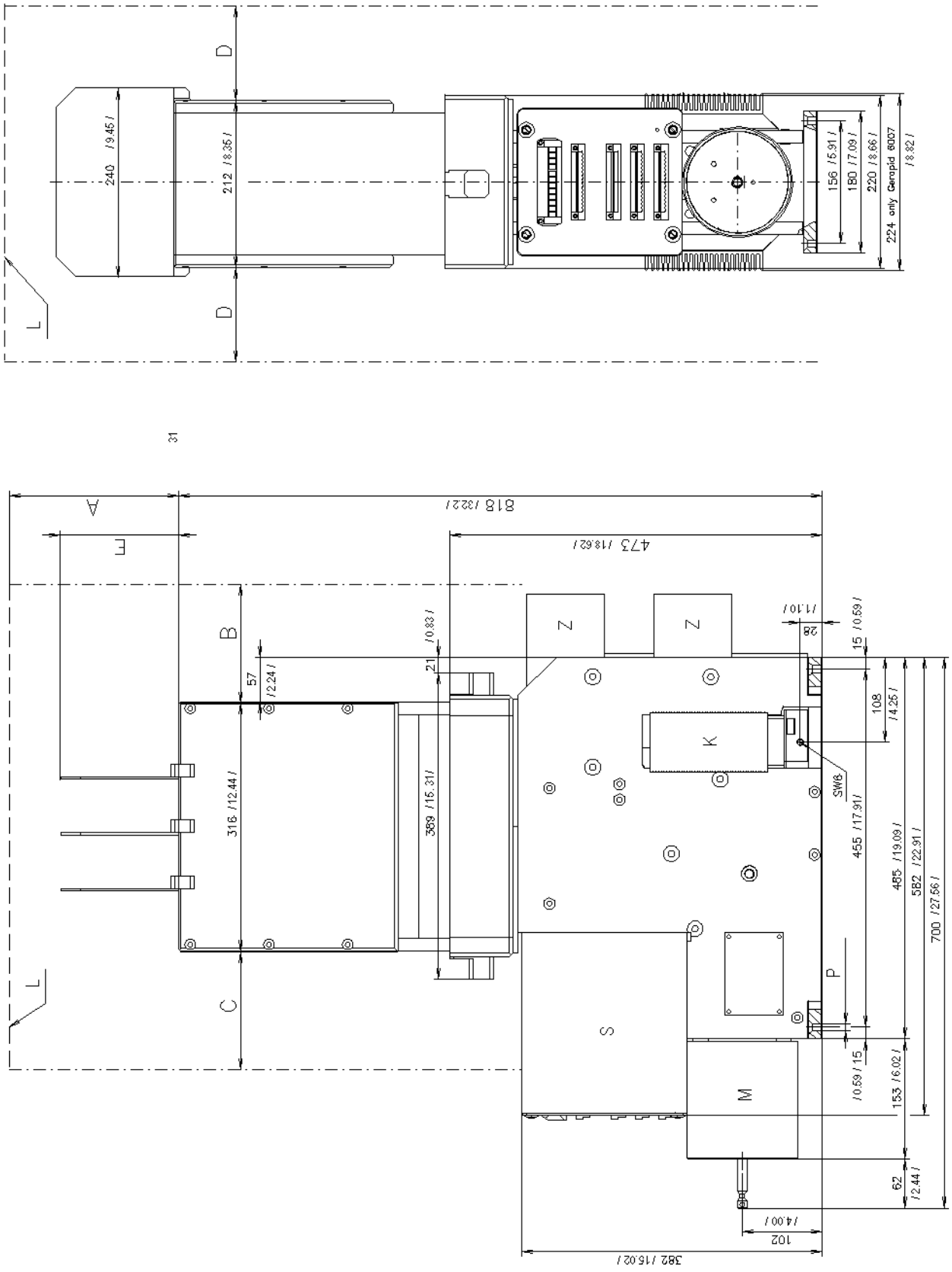


Fig. 32 Gerapid 2607- 6007, arc chute 1X (dimensions in mm and inches)

5.2.2 Gerapid 2607, 4207, 6007with arc chute 2x_

Pay attention to legend, warnings and safety distances pages 26/27!

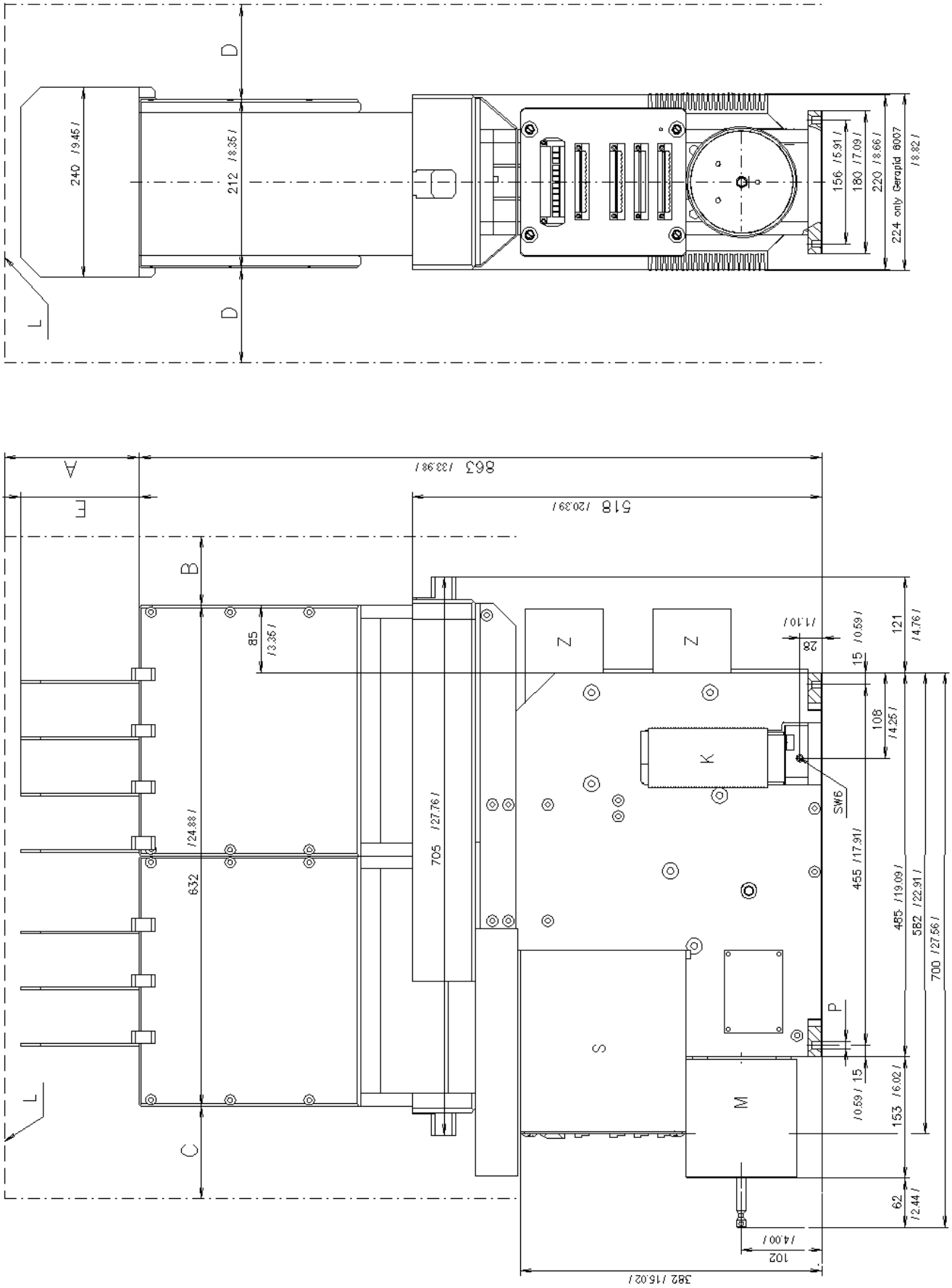


Fig. 33 Gerapid 2607- 6007, arc chute 2x (dimensions in mm and inches)

5.2.3 Gerapid 8007 with arc chute 1x_

Pay attention to legend, warnings and safety distances pages 26/27!

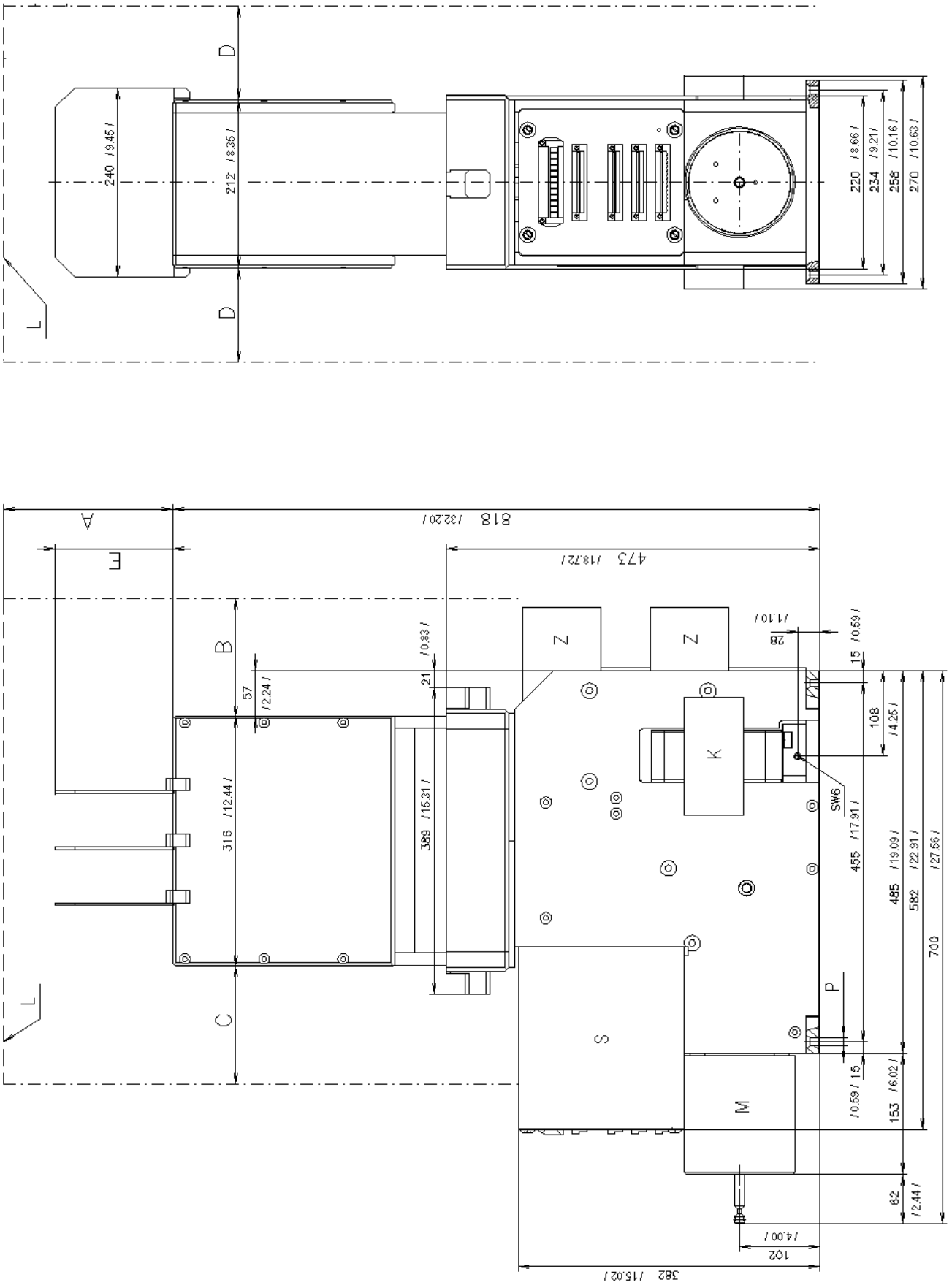


Fig. 34 Gerapid 8007 with arc chute 1x (dimensions in mm and inches)

5.2.4 Gerapid 8007 with arc chute 2x_

Pay attention to legend, warnings and safety distances pages 26/27!

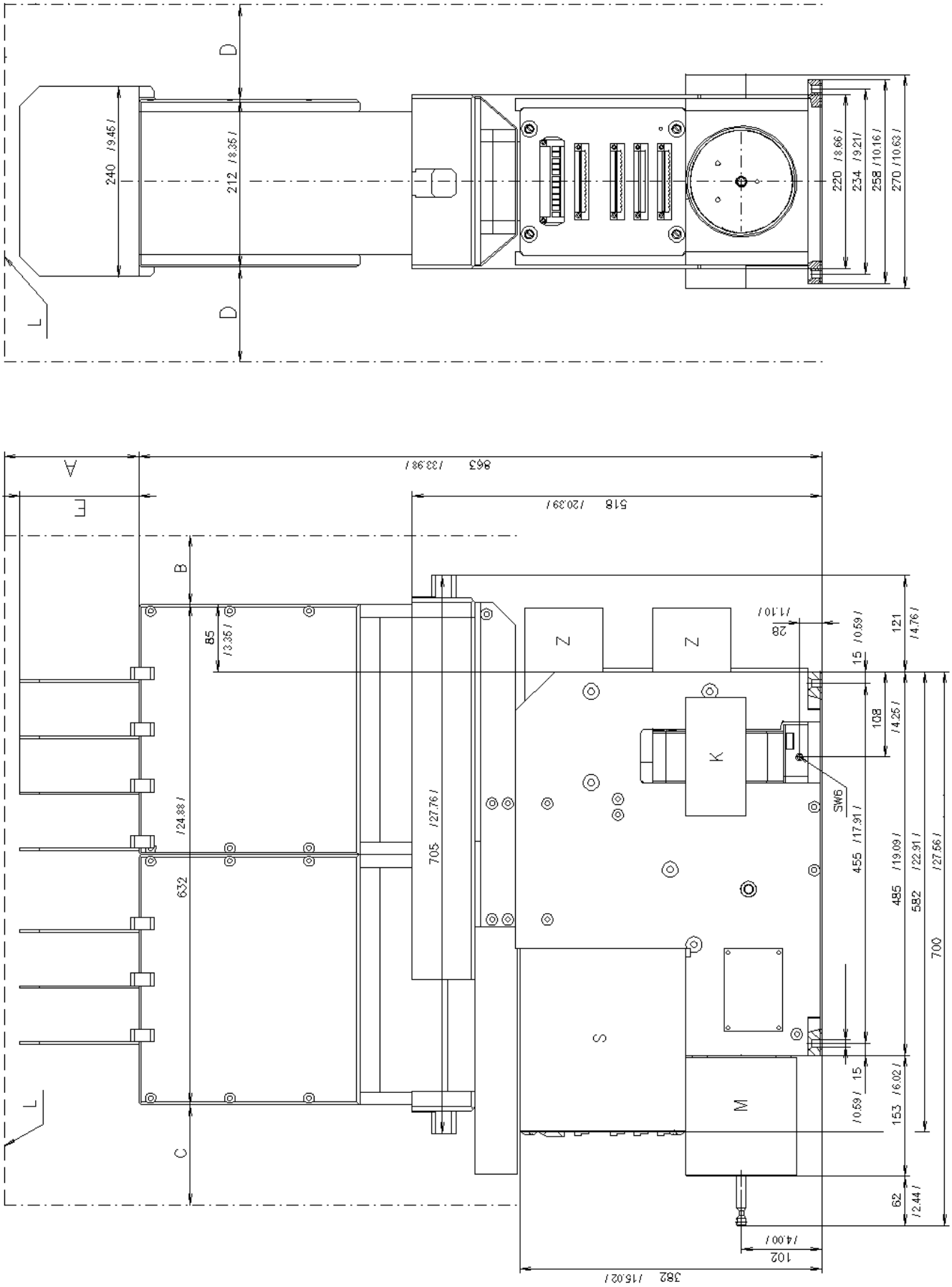


Fig. 35 Gerapid 8007 with arc chute 2x (dimensions in mm and inches)

5.2.5 Gerapid 2607, 4207 with H / H terminals

It's possible to combine horizontal and vertical connectors. Dimensions are corresponding. Note with SEL option, top connector is vertical only

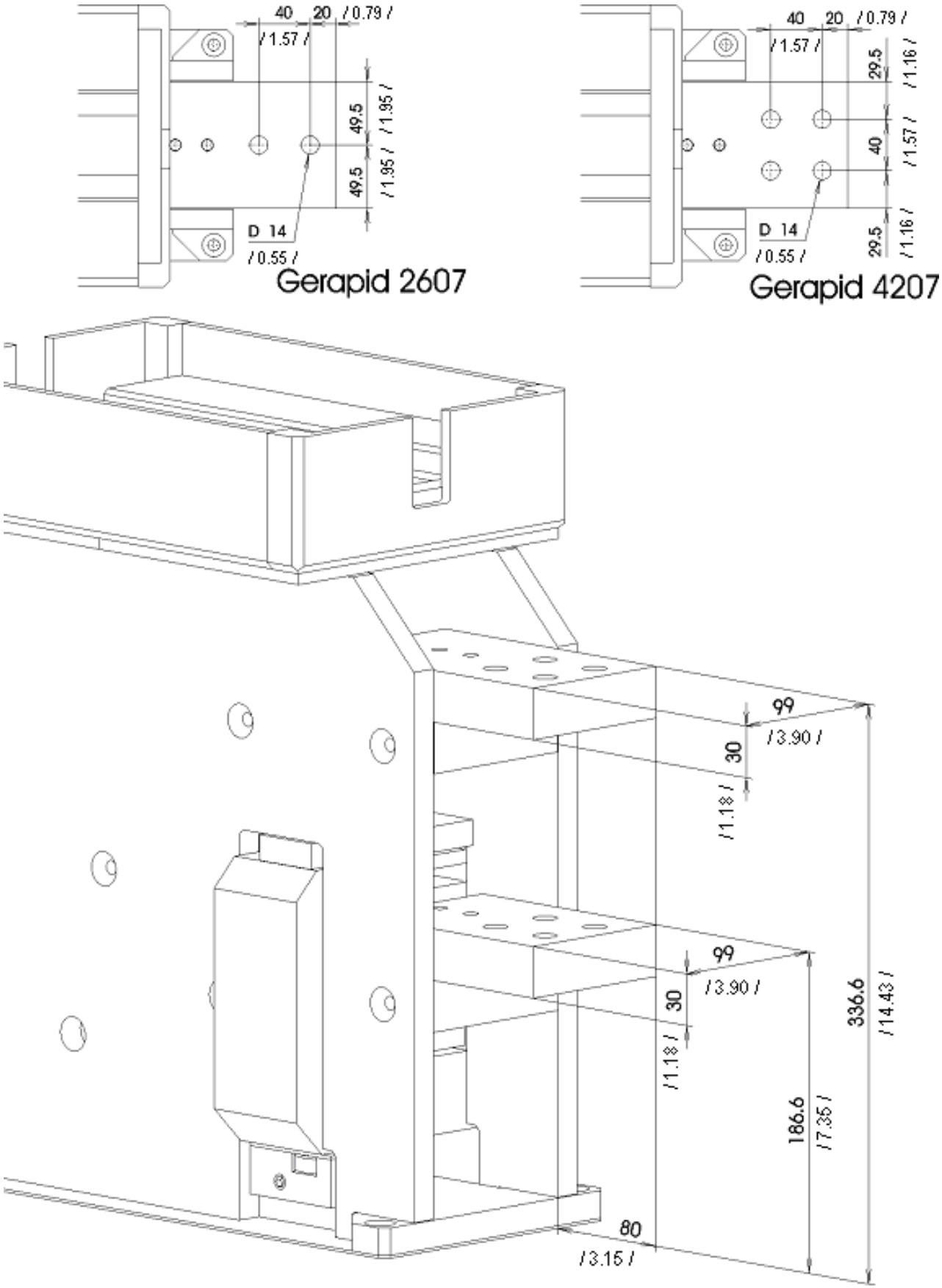


Fig. 36 Gerapid 2607, 4207 with horizontal terminals (dimensions in mm and inches)

5.2.6 Gerapid 2607, 4207 with V / V terminals

It's possible to combine horizontal and vertical connectors. Dimensions are corresponding.

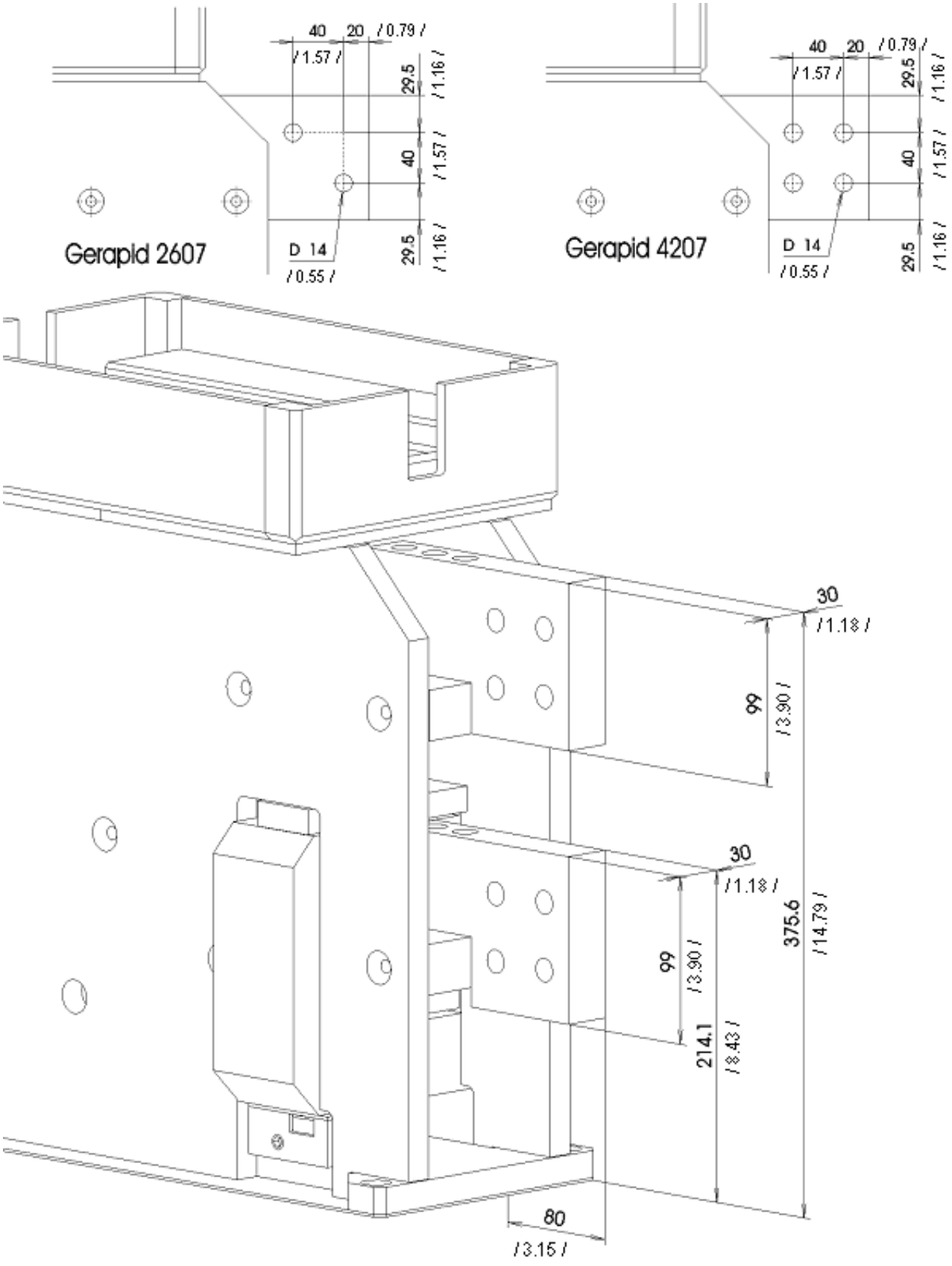


Fig. 37 Gerapid 2607, 4207 with vertical terminals (dimensions in mm and inches)

5.2.7 Gerapid 6007 terminals

Gerapid 6007 is available only with V / V terminals !

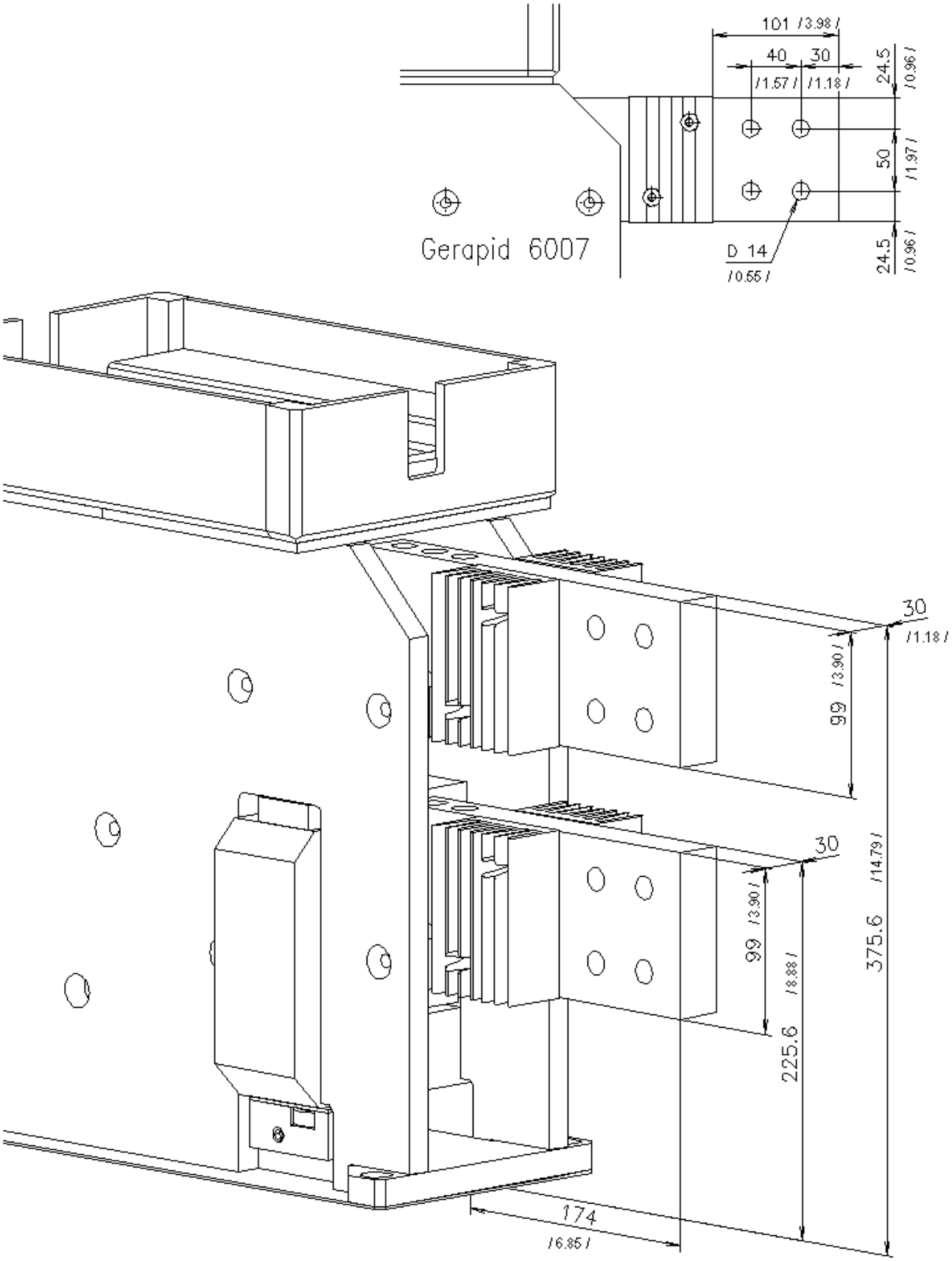


Fig. 38 Gerapid 6007 with vertical terminals (dimensions in mm)

5.2.8 Gerapid 8007 terminals

Gerapid 8007 is available only with V / V terminals !

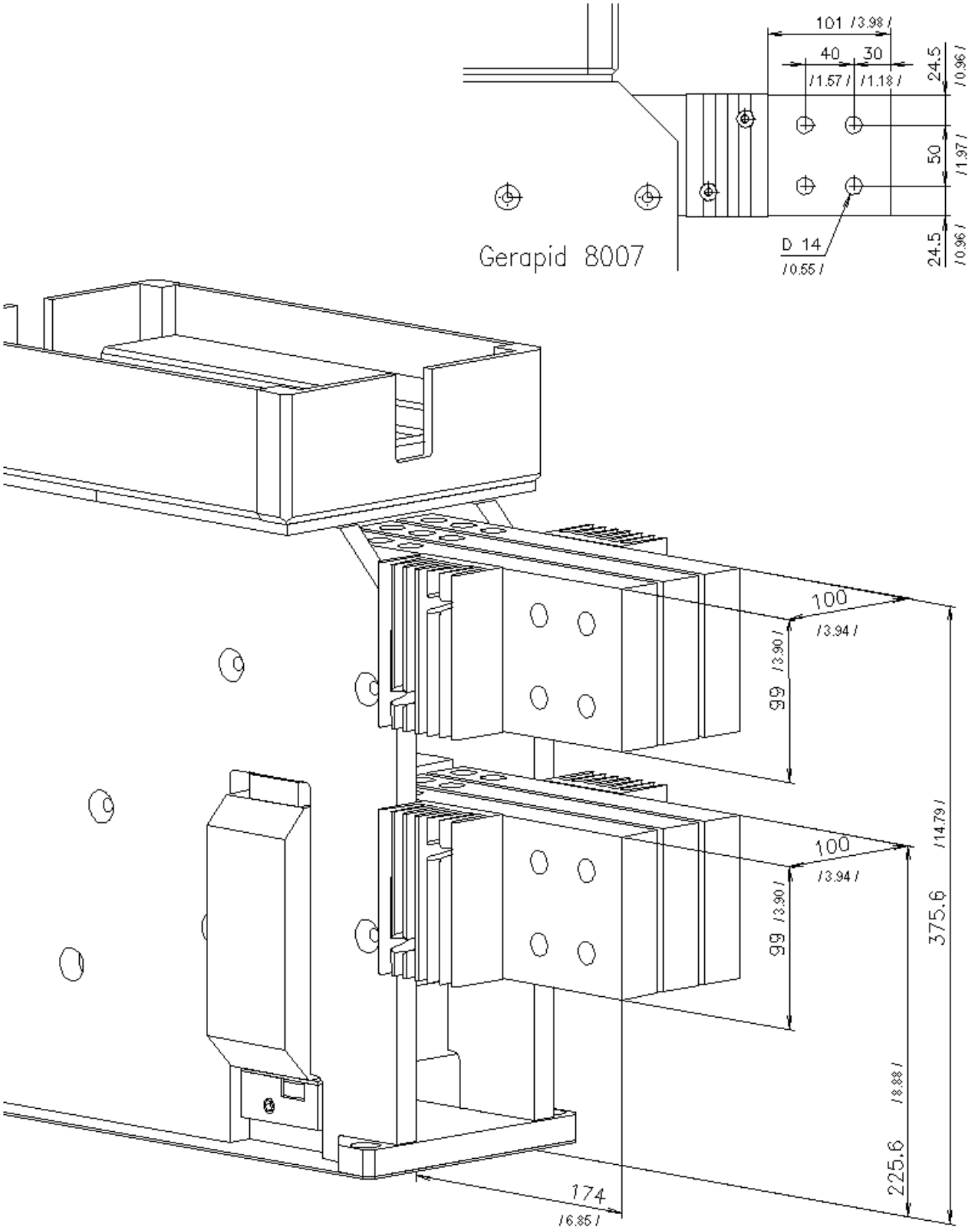


Fig. 39 Gerapid 8007 with vertical terminals (dimensions in mm and inches)

6. Inspections and maintenance

6.1 List of inspections

TYPE OF THE INSPECTION	BY WHOM	HOW OFTEN	WHAT TO DO/CHECK
A. General visual inspection	-Customer -Trained technician	Every 6-12 months	• Check for damages or cracks of the frame, adapter or arc chute • Check for missing screws or caps • Check for damaged labels • Check for corrosion • Check for distinct manifestations of flame or smoke at the frame • Clean the breaker from dirt and dust • Clean and degrease the copper terminals
B. General functional inspection	-Customer -Trained technician	Every 6-12 months	• Manually close and open the breaker to check the drive and mechanism • Close the breaker electrically and open by trip unit(s) releasing, to check controls
C. Inspection of the arc chute and contact system	-Customer -Trained technician	Every 6-12 months **or** after: • high short circuit opening at >25 kA • >300 openings at load current • >100 openings at over current load (2-3 x In) It is recommend to carry out inspection of contact system after breaking of equivalent of 150MA^{2}s total let through energy.	• Check for wear of the arc runners; shall not exceed 30 % of its cross section • Check for wear of the pre-arcing contact. It shall not exceed 2 mm [0.08 in]. • Check for wear of the main contacts at fixed and flexible sides; shall not exceed 1.5 mm [0.06 in] of its depth. • Check for wear of the arc chute plates; check for deposits inside of arc chute, this area shall be free of deposits. • Check for wear of protective walls; shall not exceed 1 mm [0.04 in]. • Check for contact tilt and gaps.
D. Inspection of the screw/bolt connections	-Customer -Trained technician	Every 6-12 months **or** after every inspection: • of the arc runners • of the contacts • of the arc chute	Check the position of the countersunk screws in the sidewalls. Check for tightness or use torque tool (torque in SI and Imperial units): • M8 ~20 Nm [~ 177 in-lbs] • M6 ~10 Nm [~ 88 in-lbs] • M5 ~5 Nm [~ 44 in-lbs] • M4 ~3 Nm [~ 26 in-lbs]
E. Inspection of the mechanic components	-GE -Service technician	Every 5 years **or** After 5.000 openings	• Carry out inspection "B" above • Check out settings of the main contacts and auxiliary switch • Check out upper dumper of the mechanism; no cracks, deformation or heavy discoloration; hard consistency; without punctures • Check out main flexband breakage; shall not exceed 30 % of its cross section • Check out wear of mini flexband; shall not exceed 30 % of its cross section • Clean and degrease UVR latch and quick latch of the mechanism. Apply dash of Beacon EP2 grease afterwards.

Required tools:
Cleaning tissue; abrasive paper; manual closing lever; hexagon wrenches SW5, SW6; Torx® wrenches size 30, 40, 45; small and medium screwdrivers; ratchet with 10 mm hex cap; pliers; tongs.
Dispose of the breakers if required:
Pay attention to the national and local regulations of disposal!

6.1.1 General visual inspection

- Check out for damages or cracks of the frame, the adapter or the arc chute.
- Check out the black marks on the countersunk screws. These marks shall be aligned together. If any screw is loosening, shall be replaced with new one, using Loctite 222. Afterwards, mark the screw with black line to sign its position in nest.
- Check out for missing screws or caps.
- Check out for damaged labels. Clean and repair.
- Check out for corrosion. In case of significant corrosion, please contact GE representative for assistance.
- Check out for distinct manifestations of flame or smoke at the frame. Especially in lower area of the breaker. Please document and contact GE representative for assistance.
- Clean the breaker of dirt and dust. Remove all dirt with a dry cloth. No particularly high signs of abrasion (rough chips) should be visible anywhere.
- Clean and degrease the copper terminals.

6.1.2 General functional inspection

Pay attention to the warnings, Section 1!

- In order to check the latch mechanism, the breaker can be opened and closed with a hand lever.

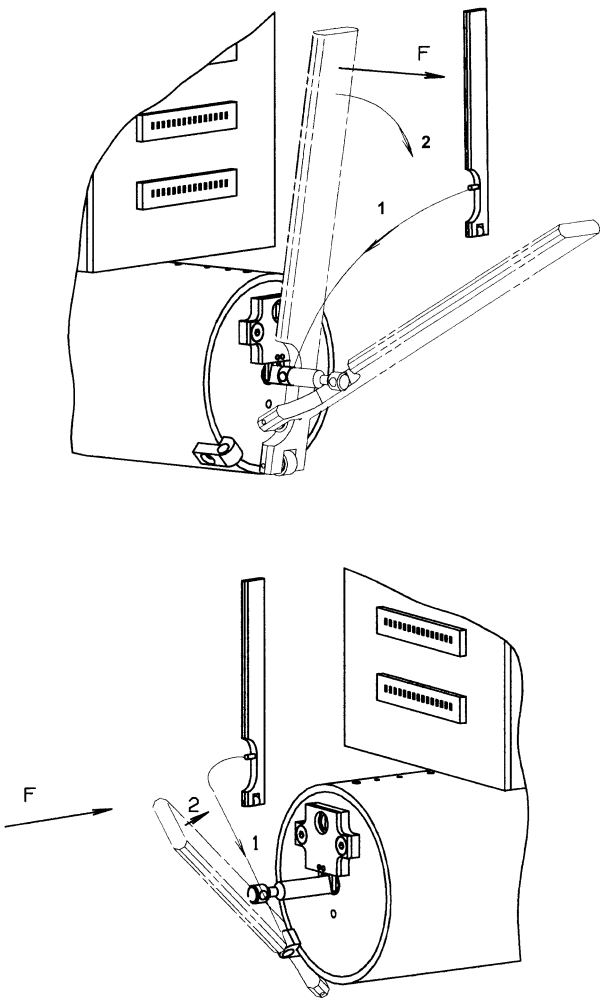


Fig. 40 Using of the hand lever

- Re-energize the control circuits and switch the breaker ON and OFF several times using ST or UVR, and using closing drive. The contacts must close after the CLOSE command and must open following the OPEN command
- The breaker mechanism must not appear sluggish nor must ON/OFF be unduly delayed.

6.1.3 Inspection of the arc chute

Pay attention to the warnings, Section 1!

A) Remove the arc chute

- [Fig. 41]. Take off isolation caps (6). Loosen the clamping screws (3) and (4), using SW5 hexagon wrench and take off the arc chute (1) from the adapter (2).

B) Check the arc chute

- [Fig. 42]. Check the arc chute's interior, as far as possible, for deposits (1). There should be no copper pearls on the metal-plates, which could partially short the plates.
- [Fig. 42]. Check the general condition of the insulation plates (4). These shall not be bent or burned. Also other insulation shall not be heavily damaged.
- [Fig. 42]. Check the arc horns (2). The cross section shall not be reduced more than ~30 %.
- [Fig. 42] Check the splitting plates (3). These shall not be burned more than ~20 mm [~0,8 in].

C) Install the arc chute

- [Fig. 41]. Put arc chute (1) into adapter (2).
- [Fig. 41]. Tighten front and backside connections of the arc runners (3), including lock washer. Use a torque of 10 Nm [88 in-lbs].
- [Fig. 41]. Tighten front- and backside of the arc chute connections (4), including flat washers. Use a torque of 5 Nm [44 in-lbs].
- [Fig. 41]. Put on isolation caps (6).

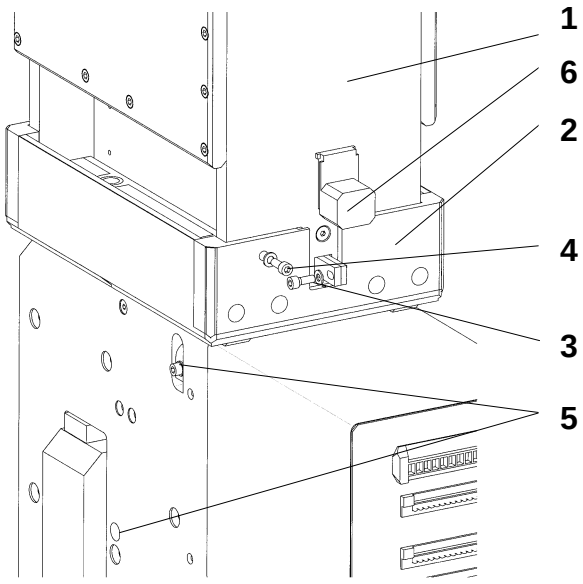


Fig. 41 Arc chute and arc runners fixing

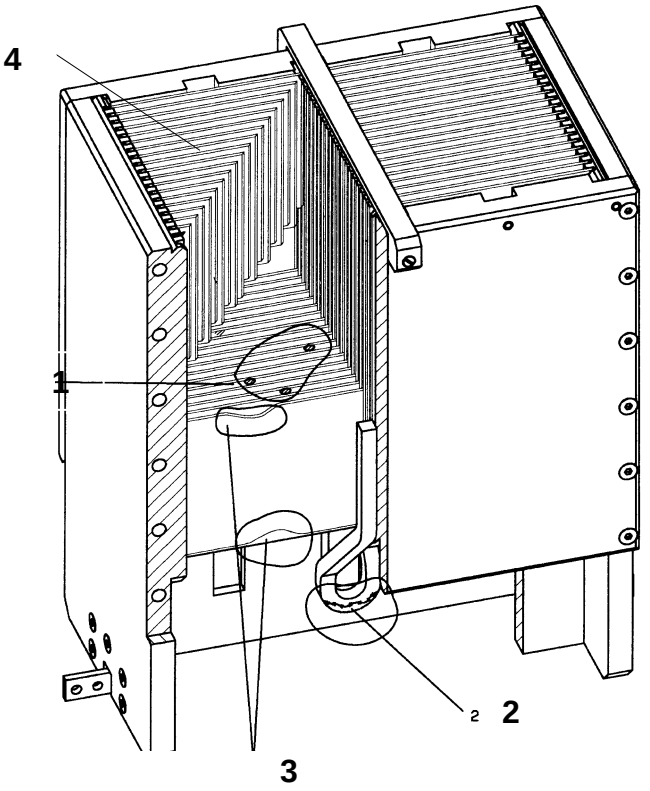


Fig. 42 Inspection of the arc chute

6.1.4 Inspection of the contact system

Pay attention to the warnings, Section 1!

A) Remove the arc chute

- [Fig. 41]. Loosen the clamping screws (3) and (4), using SW5 hexagon wrench and take off the arch chute (1) from the adapter (2).

B) Remove the arc chute adapter

- [Fig. 43]. To dismantle the arc chute adapter, loosen and pull out the four upright screws (1) using SW5 tool. Pay attention that no screws or washers fall inside the breaker!
- [Fig. 43]. Draw aside and lift off both parings of adapter (2). Then pull out two protective walls (3).

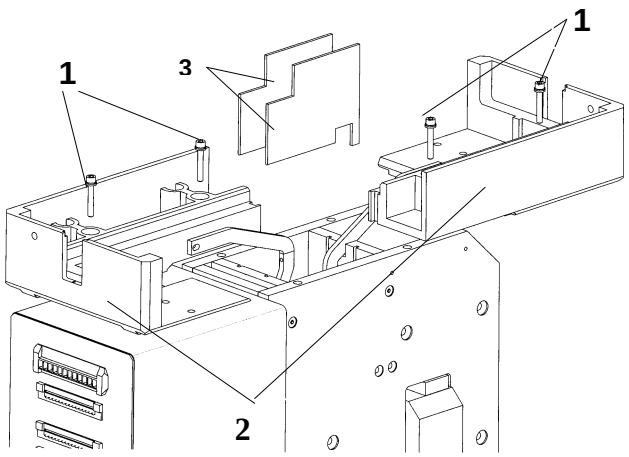


Fig. 43 Adapter and protective walls

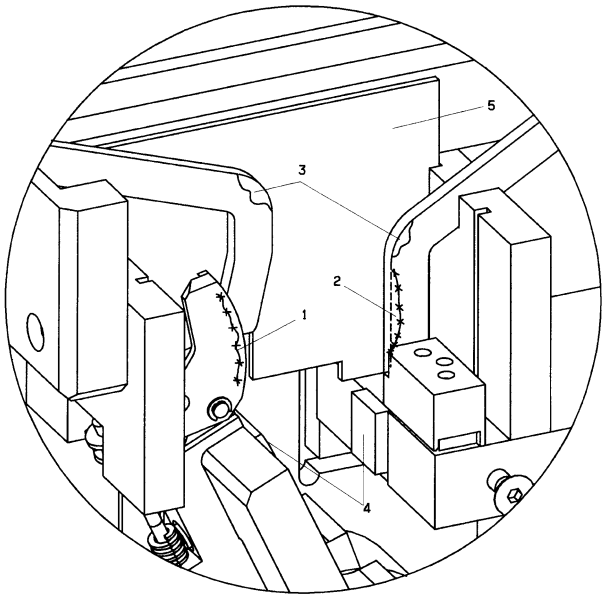


Fig. 44 Checking the contact system

C) Check the protective walls

- [Fig. 44]. The material burn out on the protective walls (5) shall not exceed 1 mm [0.04 in] at any place.

D) Check the arc runners

- [Fig. 44]. The arc runners should not be burned more than 30 % of its total cross section. Pay particular attention to the area around arc runner bend (3) and at contact point with arcing contact (2).

E) Check the arcing contact

- [Fig. 44]. Wear of the arcing contact (1) must not exceed 2 mm [0.08 in] of its depth. Replace the arcing contact in that case. If contact erosion exceeds 4 mm [0.16 in], major contact system failure is possible.

F) Check the main contacts

- [Fig. 44]. The main contacts (4) shall not show any particular signs of material erosion, since the arc is ignited between the arcing contacts. It means, that for rated and overload currents there should be no erosion of main contacts.
- Erosion of main contacts can take place only in case of excessively worn, highly burned arcing contact or during very high short circuit currents. In that case wear must not exceed 1.5 mm [0.06 in].

G) Install the adapter

- [Fig. 43]. Install the two protective walls (3). Use new ones if necessary. Install two parings of adapter (2) and tighten screws (1) use 10 Nm [88 in-lbs].

H) Install the arc chute

- [Fig. 41]. Put arc chute (1) into adapter (2).
- [Fig. 41]. Tighten front and backside connections of the arc runners (3), including lock washer; use 10 Nm [88 in-lbs].
- [Fig. 41]. Tighten front and backside of the arc chute connections (4), including flat washers; use 5 Nm [44 in-lbs]. Put on isolation caps (6).

6.1.5 Inspection of contacts' tilt and gap

Pay attention to the warnings, Section 1!

A) Remove the arc chute and adapter

- See 6.1.4-A/B.

B) Check the tilt of the main contacts

- [Fig. 45]. Use the hand lever for slowly closing the main contacts.
- [Fig. 46]. Once the arcing contact touches arc runner, check the air gap between main contacts. The gap between main contacts shall have more than 1 mm [0.04 in].
- In case of insufficient tilt (gap), replace the arcing contact with new one. See 6.2.1 and 6.2.2 for details.
- If required gap is not available, even after component replacing, please contact GE Service Team.

C) Check the air gap of arcing contact

- Close the breaker and **secure the solenoid drive against unintended opening.** See 1.2.1.
- [Fig. 47]. Check the air gap between the arcing contact and main arm. It shall be minimum 1 mm [0.04 in].
- In case of insufficient gap, replace the arcing contact with new one. See 6.2.1 and 6.2.2 for details.
- If required gap is not available, even after contact replacing, please contact GE Service Team.

D) Install back adapter and arc chute

- See 6.1.4-G/H.

6.1.6 Inspection of the screw connections

Pay attention to the warnings, Section 1!

- [Fig. 41]. Tighten front and backside of the arc runner screw connections (3) and (5). Use torque of 10 Nm [88 in-lbs].
- [Fig. 41]. Tighten arc chute connections (4). Use torque of 5 Nm [44 in-lbs].
- [Fig. 41]. The arc runner's screw connections (3) must be secured by means of lock washer.
- [Fig. 41]. The arc chute's screw connections (4) must be secured by means of flat washer.
- Any other screws shall be tightening with applied torques from Table 3-D.
- Ensure that the screws are in good condition, that thread and nest are not damaged. Surface shall be free from rust. Replaced any screw, which does not fulfill above conditions.
- This check must be carried out prior to commissioning and after maintenance.

6.1.7 Inspection of the mechanical components

Only GE Service Team or its representative shall perform this inspection. These require major disassembly and adjustment of the breaker. Customer, without supervision of trained specialist, shall not execute these.

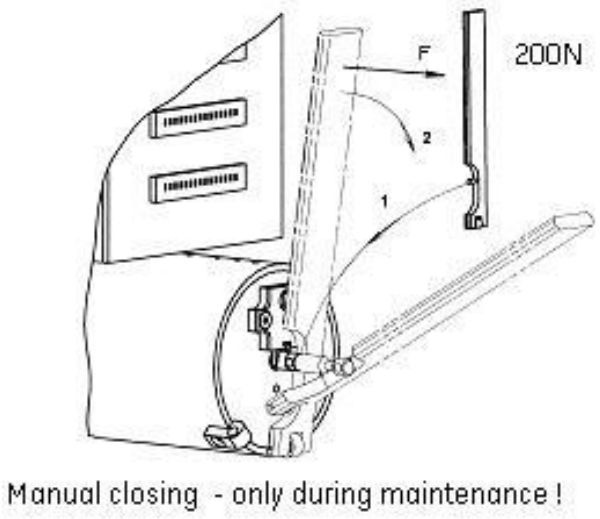


Fig. 45 Closing operation by using hand lever

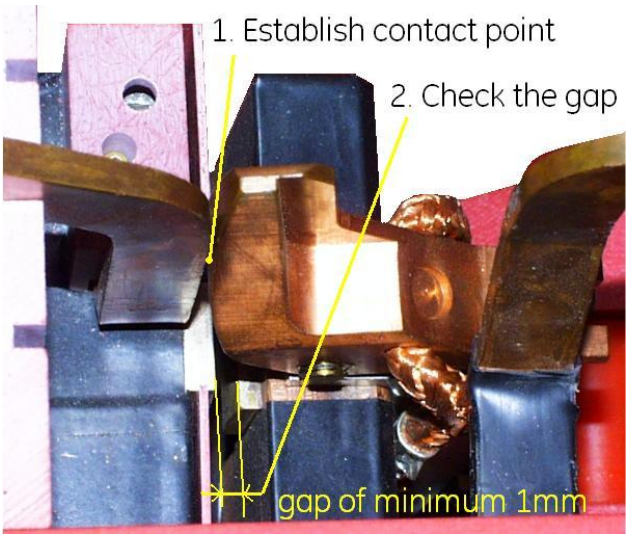


Fig. 46 Inspection of the main contacts' tilt

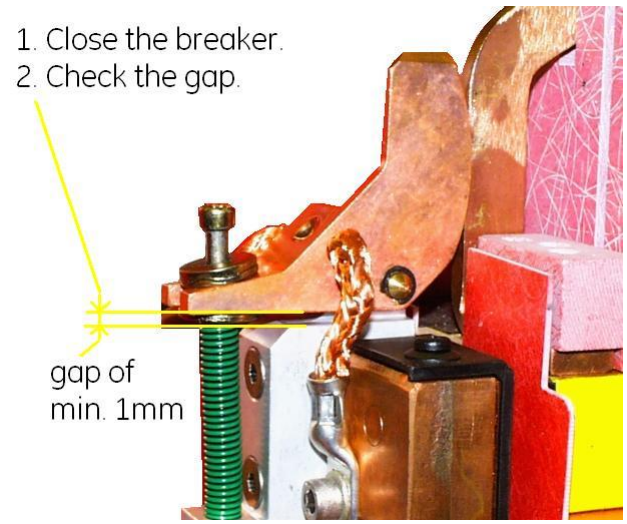


Fig. 47 Inspection of the arcing contact's air gap

6.2 List of maintenance works

TYPE OF THE WORK	BY WHOM	WHEN REQUIRED	RECOMMENDATIONS
A. Arc chute changing	-Customer -Trained technician	As a result of the inspection C	
B. Arcing contact and arc runners changing	-Customer -Trained technician	As a result of the inspection C	Replace complete arcing set.
C. Protective walls changing	-Customer -Trained technician	As a result of the inspection C	
D. Adjustment of the contacts	-GE Service Engr	As a result of the inspection C	Only when replacement of the arcing contact results with incorrect gaps. See point 6.1.5.
E. Replacement of the control board	-Customer -Trained technician	As a result of the inspection B,E	
F. Adjustment of the mechanism	-GE Service Engr	As a result of the inspection B,E	
G. Flexband or fixed contact changing	-GE Service Engr	As a result of the inspection C,E	
H. Mechanism changing	-GE Service Engr	As a result of the inspection B,E	
I. Dumper(s) changing	-GE Service Engr	As a result of the inspection E	Replace upper and lower dumper at the same time.
J. Trip unit changing & adjustment	-GE Service Engr	As a result of the inspection B,E	
K. Auxiliary contacts adjustment and changing	-Customer -Trained technician	As a result of the inspection B,E	In case of improper operation of the switches, adjustment might be necessary.
L. Drive changing	-GE Service Engr	As a result of the inspection B,E	
M. Accessories changing	-GE Service Engr	As a result of the inspection B,E	

Table 4

Required tools:

- Cleaning tissue
- Pocket lamp
- Hand lever
- Hexagon wrench SW 4, SW 5, SW 6
- Screw wrench SW 10, SW 13
- Torx® wrench size 30, 40 and 45
- Small and medium screwdriver
- Pliers
- Wire cutter
- File
- Steel brush

Safety hints:

Securing against falling parts

Hint 1 Place a cloth into the lower area of the arcing contact [Fig. a]. Remember to secure the closing drive according to Hint 3.

Fig. a Protecting of the arcing area against falling parts

Maintenance with zero voltage release

Hint 2 If an optional zero voltage release is installed, it must be energized to enable closing of the breaker. Only then maintenance of the arcing contacts is possible.

Hint 3 To prevent the risk of injury, it is recommended to secure the breaker in the closed position with a simple mechanical interlock device [Fig. b]. A piece of tubing having ~50 mm [~2 in] length and inner diameter of minimum 14 mm [0,55 in] works well. The outer diameter of the locking rod shall be less 8 mm [0,3 in]. GE does not offer this locking device.

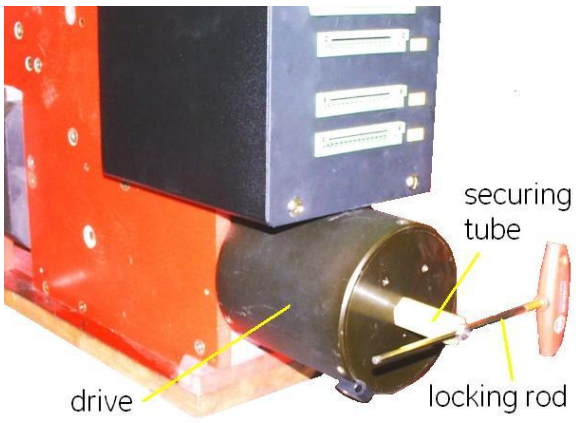


Fig. b Securing closing drive against opening

6.2.1 Contact system (after 11/2003).

Pay attention to the warnings, Section 1!

This section is valid for breakers manufactured after 11/2003.

This section refers to maintenance works A, B, C from Table 4.

A) Remove the arc chute

- [Fig. 49]. Loosen the screws (3) and (4), using SW5 hexagon wrench and take off the arch chute (1) from the adapter (2).

B) Remove the arc chute adapter

- [Fig. 48]. To dismantle the arc chute adapter, loosen and pull out the four upright screws (1) using SW5 tool. Pay attention that no screws or washers fall inside the breaker!
- [Fig. 48]. Draw aside and lift off both parings of adapter (2). Then pull out two protective walls (3).

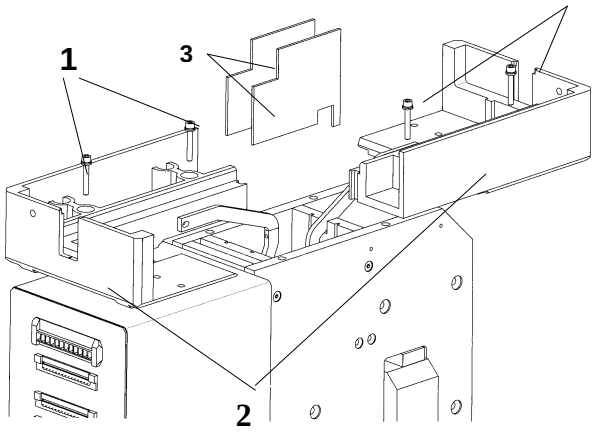


Fig. 48 Adapter and protective walls

C) Changing the protective walls, arc runners and arcing contacts

- [Fig. 48]. Pull out two protective walls (3).
- [Fig. 50]. Loosen screws (6a) with tool (SW4) and take out front wall (6).
- [Fig. 50]. Loosen screw (5a) with tool (SW5) and take out the front arc runner (5).
- [Fig. 50]. Take out the back arc runner (4) by loosening two screws (4a) with tool (SW5). Don't remove the protective cap (4b).
- [Fig. 50]. Loosen and take out screw (7) including locking plate (8). Don't split up screw and locking plate!
- [Fig. 50]. Pull out axis pin (9). Pull out arcing contact (10) and put in new arcing contact.
- [Fig. 50]. Put in axis pin (9) and protect it by the locking plate (8). Tighten screw (7) with torque of 10 Nm [88 in-lbs].
- [Fig. 50]. Install front-arc runner (5) and back-arc runner (4). Tighten it using torque of 10 Nm [88 in-lbs].
- [Fig. 50]. Install front wall (6) and adjust it by positioning the protective wall. Tighten with torque of 10 Nm [88 in-lbs].
- [Fig. 48]. Put in two protective walls (3).

D) Install the adapter

- [Fig. 48]. Install two protective walls (3). Use new ones if necessary. Install two parings of adapter (2) and tighten screws (1); use 5 Nm [44 in-lbs].

E) Install the arc chute

- [Fig. 49]. Put in arc chute (1) into adapter (2).
- [Fig. 49]. Tighten front- and backside connections of the arc runners (3), including lock washer; use 10 Nm [88 in-lbs].
- [Fig. 49]. Tighten front- and backside of the arc chute connections (4), including flat washers; use 5 Nm [44 in-lbs].

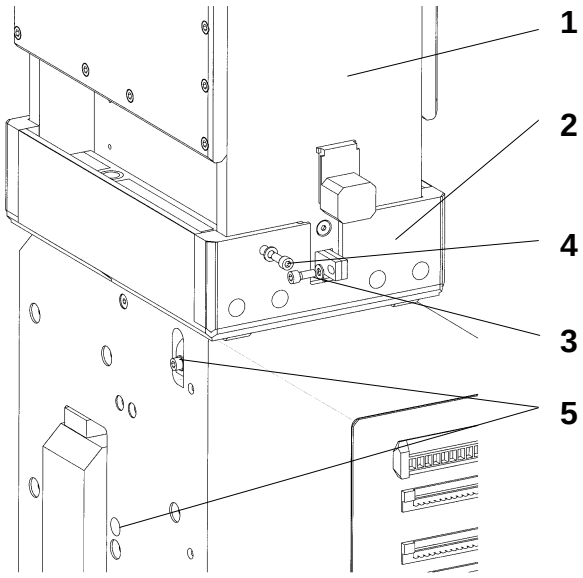


Fig. 49 Arc chute and arc runners fixing

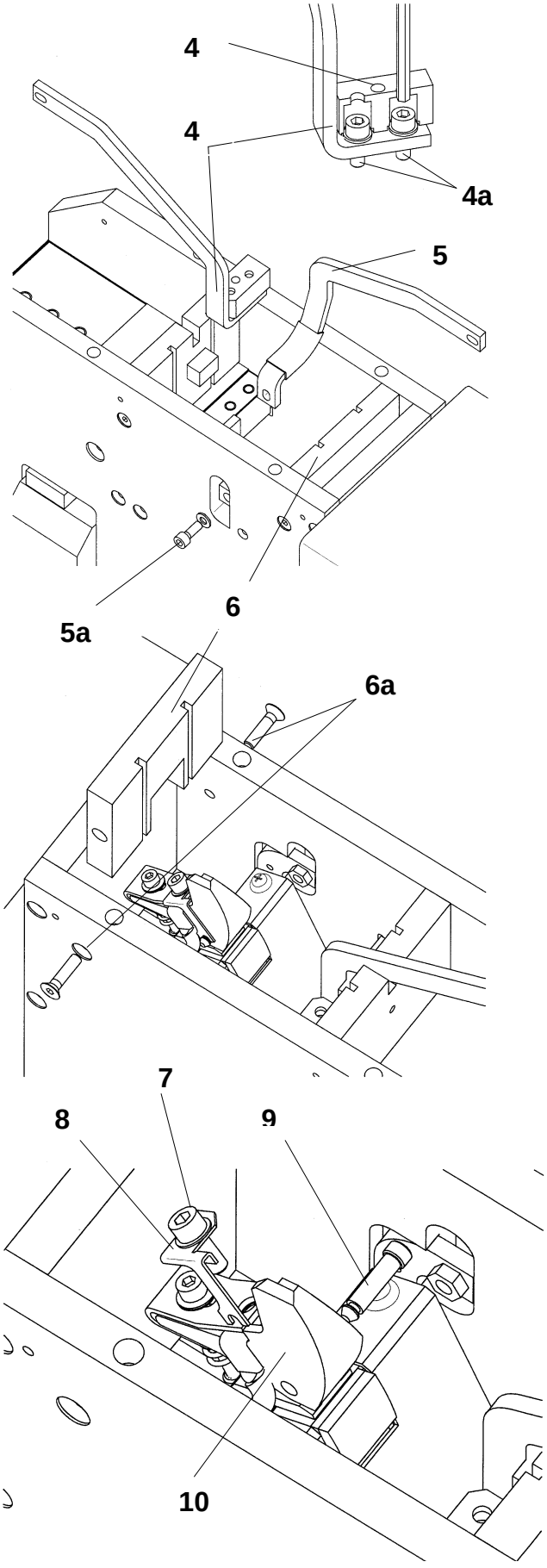


Fig. 50 Changing arcing contact.

6.2.2. Contact system (before 11/2003).

Pay attention to the warnings, Section 1!

This section is valid for breakers manufactured before 11/2003.

This section refers to maintenance works A, B, C from Table 4.

A) Remove the arc chute and adapter

- See 6.2.1-A/B.

C) Changing the protective walls and arc runners

- [Fig. 48]. Pull out two protective walls (3).
- [Fig. 50]. Loosen screws (6a) with Torx® 30 and take out front wall (6).
- [Fig. 50]. Loosen screw (5a) with tool (SW5).
- [Fig. 50]. Take out the front arc runner as it's shown.
- [Fig. 50]. Take out the back arc runner (4) by loosening two screws (4a) with tool (SW5). Don't remove the protective cap (4b).
- [Fig. 50]. Install new front-arc runner (5) and new back-arc runner (4). Tighten it using torque of 10 Nm [88 in-lbs].
- [Fig. 50]. Install front wall (6) and adjust it by positioning the protective wall (3) [Fig. 48]. Tighten it using torque of 10 Nm [88 in-lbs]
- [Fig. 48]. Put in two new protective walls (3).

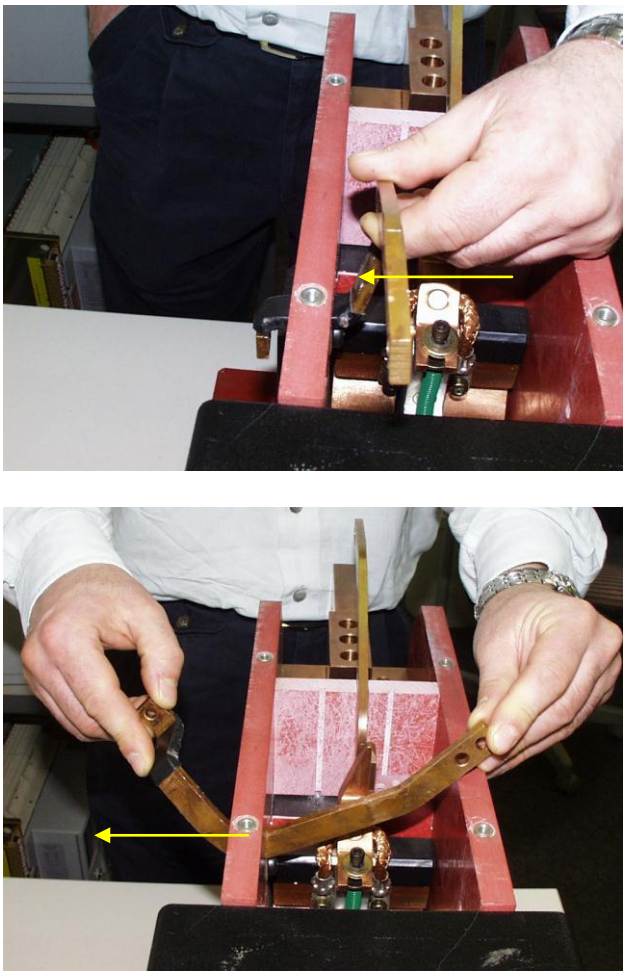


Fig. 51 Taking out the front arc runner of old design

D) Changing the arcing contact

- Remove front and back arc runner. See 6.2.2-C.
- Close the breaker and **secure the solenoid drive against unintended opening.** See 1.2.2.
- **Secure the contact area against parts falling inside the breaker**. See 1.2.1.
- [Fig. 52-1]. Initially loosen two braid's screws with tool, and unbolt them finally by hand.
- [Fig. 52-2]. Remove the safety ring from axis pin end.
- [Fig. 52-3]. Pull out the axis pin from contact.

Fig. 52-1 Unscrew cooper braid

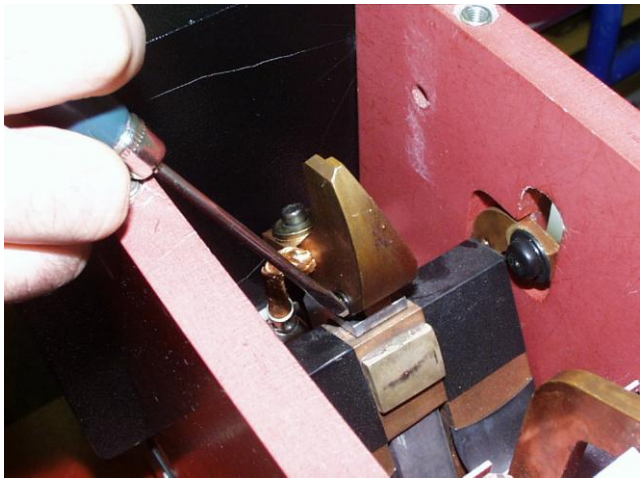


Fig. 52-2 Remove safety ring

Fig. 52-3 Remove axis pin

- [Fig. 52-4]. Replace arcing contact with new one. Use old contact to lift up two washers, and slip the new contact under these. Remove old contact and rotate the new one by 180 ° to its normal orientation.
- [Fig. 52-2/3]. Re-install the axis pin and safety ring.
- [Fig. 52-5]. Initially screw in braid's screws by hand.
- [Fig. 52-6]. Tighten these by torque of 10 Nm [88 in-lbs].
- Install back the arc runners. See 6.2.2-C.
- Check the adjustments according to point 6.1.5-C.
- Install back adapter and arc chute. See 6.2.1-D/E.

Fig. 52-4 Replace arcing contact

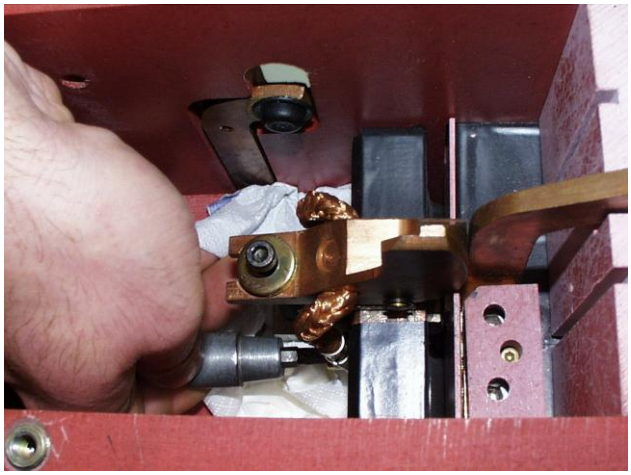


Fig. 52-5 Tighten braid's screws by means of hand

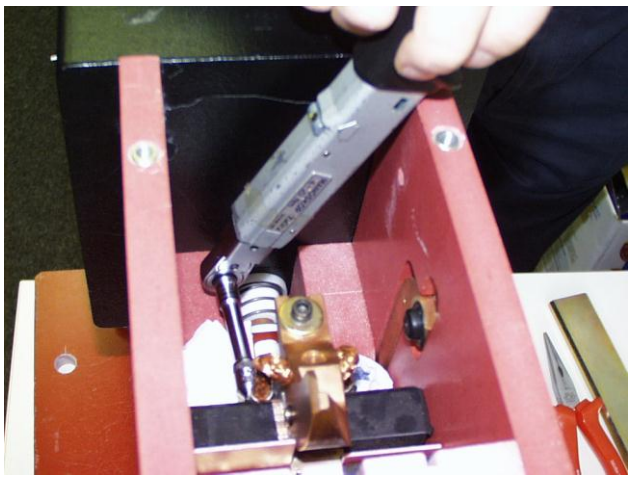


Fig. 52-6 Tighten braid's screws with torque of 10Nm

6.2.3 Layout of control PCB inside control box

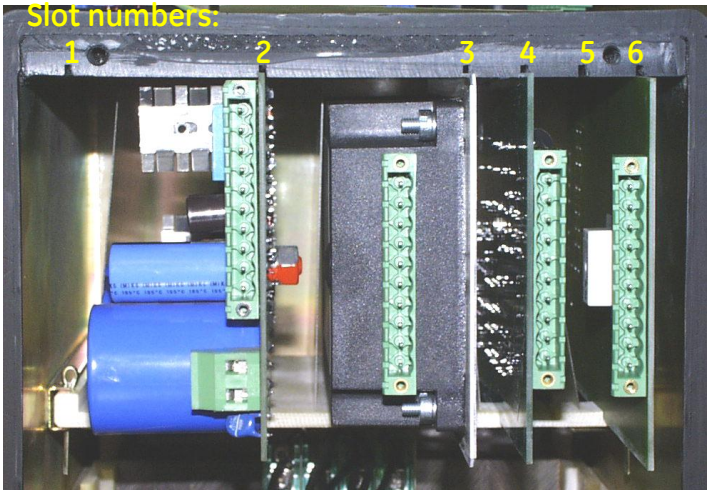


Fig. 53 Control box inside (w/o SEL unit)

Slot	Control board	Z-No.	Orientation
1	-	-	-
2	NEKO unit (ED trip)	128 750 R1	equipment to left
3	Voltage converter	128 730 R2-R4	equipment to left
4	SU-control unit	128 700	equipment to right
5	-	-	-
6	ST/UVR control unit	128 710 R1, R2	equipment to left

Table 5 Layout of control PCBs inside the box w/o SEL

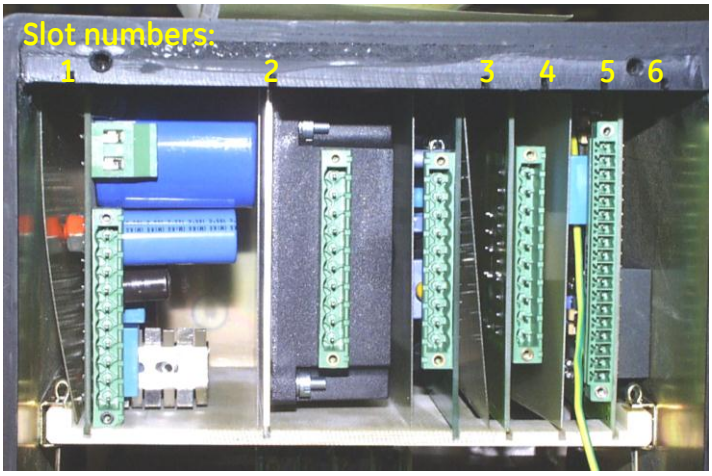


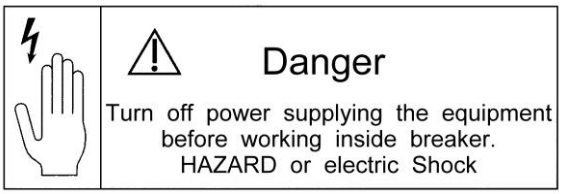
Fig. 54 Control box inside (with SEL unit)

Slot	Control board	Z-No.	Orientation
1	NEKO unit (ED trip)	128 750 R1	equipment to right
2	Voltage converter	128 730 R2-R4	equipment to right
3	SU-control unit	128 700	equipment to left
4	ST/UVR control unit	128 710 R1, R2	equipment to right
5	-	-	-
6	SEL control unit	128 785 R1-R2	equipment to left

Table 6 Layout of control PCBs inside the box with SEL

- **Warning:** The isolation plates between the control boards and at the wall of the box must always be present!
- **Hint:** In older systems, the control boards may be installed turned 180 °!

6.2.4 Replacement of the control boards



1. OPEN the breaker.
2. Disconnect power supply, and pull out all the plugs from control box's terminals.
3. If a NEKO control unit is installed, wait 1 minute until capacitors discharge.

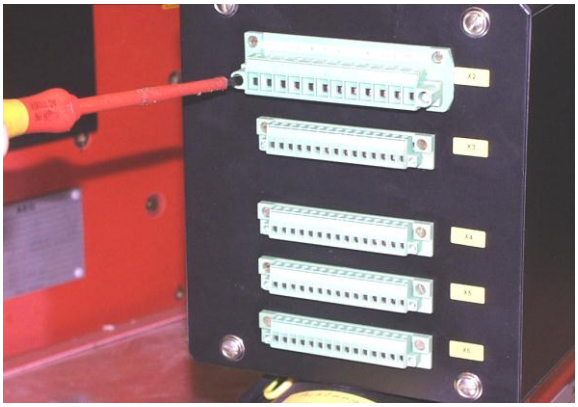


Fig. 55-1 Unscrew and remove all the external plugs

Fig. 55-2 Unscrew four bolts of the box cover

Fig. 55-3 Carefully lower the box cover

Fig. 55-4 Unscrew all the plugs from control boards

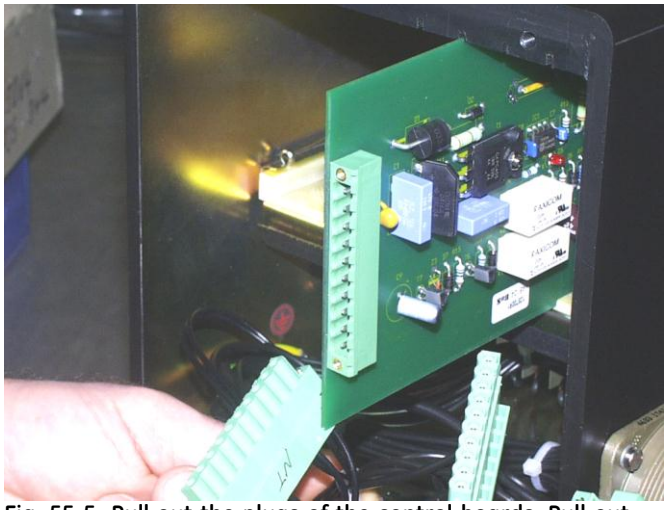


Fig. 55-5 Pull out the plugs of the control boards. Pull out selected control board. Insert new control board

- Listen that both, the isolation plate at the side of equipment and the isolation plate at the side of soldering, were inserted!

Fig. 55-6 Plug in all control plugs and tighten it by the screws.

Fig. 55-7 Pay attention, that no cables will be pinched between box and front cover during closing!

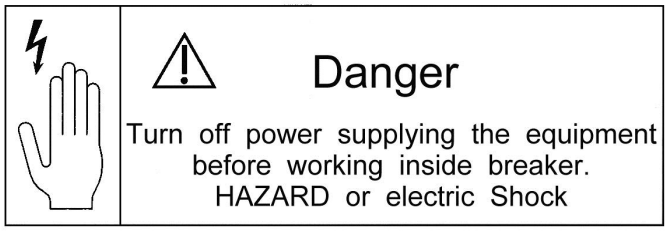
Fig. 55-8 Carefully replace the control box front cover and attach the with the four screws

- Put on plugs X2...X6, fix the screws of the plugs and switch on control voltage.

Checking the breaker:

- Open and Close the breaker 3 times while it is disconnected from the system (in the "Test-position" of the draw out version/the installation). The breaker must open and close without a time delay over 400 ms.
- If the test succeeds, reconnect the breaker to the main circuit.

6.2.5 Adjusting the auxiliary switch



1. OPEN the breaker.
2. Disconnect power supply, and pull out all the plugs from control box's terminals.
3. In case of NEKO control unit inside, wait 1 minute until capacitors discharge.

- Adjustment of the switches may be required if they fail to provide correct position indication. This condition can be caused by misalignment of the actuating plate (6) [Fig. 56-3], represented by dashed line.
- If only 3 or 5 switches are installed in the center of the block, plate misalignment will not occur (breakers built after 2003).
- In the case of 10 switches or when switches are mounted at the far left position, it might be needed (breaker before 2003). In most cases, only far left or far right mounted switches might need to be re-adjusted.
- Check all the switches operation to establish which need to be re-adjusted (left or right side).
- OPEN the breaker.
- [Fig. 56-1] Loosen four screws (2). Move the front cover (1) slowly down. The auxiliary switch block (3) is accessible now, in the bottom of the compartment.
- [Fig. 56-2] Loosen screw (4) on the side (left or right), which needs to be re-adjusted. Turn the proper adjusting screw (5) clockwise, until all contacts switch properly. **Warning!** Adjusting screw (5) too far in may over compress the switches' pin and cause breakdown.
- [Fig. 56-1] Check the correct signalization of all switches at the connecting plug terminations X4, X5! If necessary re-adjust the switches from other side.
- Now tighten solid the screws (4).
- [Fig. 56-1] Close the control box with front cover (1) by fixing the four screws (2). Pay attention, that no cables will be pinched between box and front plate.
- CLOSE the breaker several times. Check if the auxiliary contacts are switching over correctly.
- Finally check the electrical functions in the "TEST-position" of the draw-out version after installing the breaker into the substation.

If re-adjustment does not help, please contact GE Service Team. It might be required to install switch block again or to move switches to center of the block for better performance.

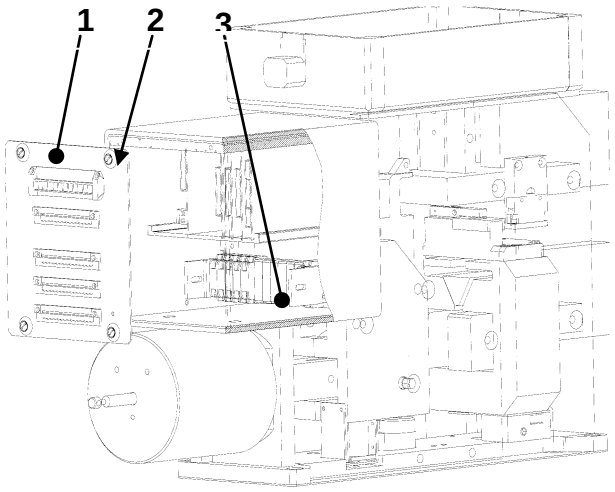


Fig. 56-1 Control box with auxiliary switch block

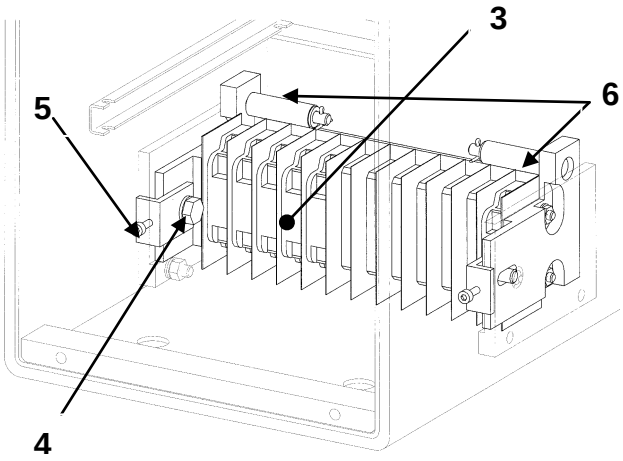


Fig. 56-2 Auxiliary switch block

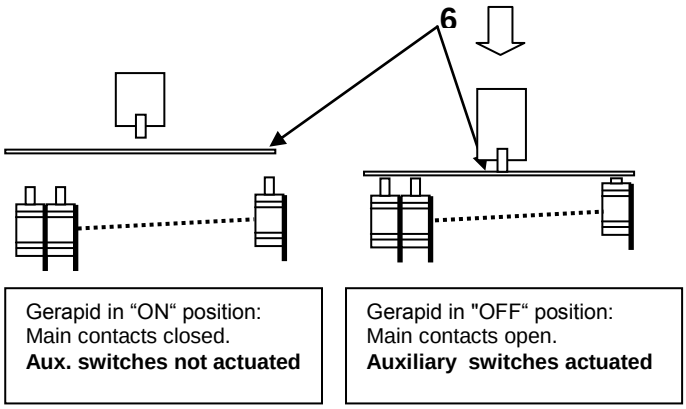


Fig. 56-3 Actuating plate for auxiliary switch block

6.3 Spare parts lists.

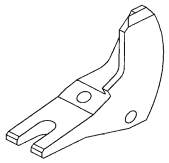
6.3.1 Mechanical spare parts.

NOTE: Gray-shaded parts are recommended for a maintenance stock, as applicable to your specific breaker configuration.

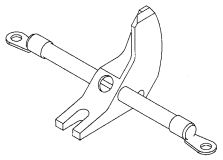
Component	Type	Arc chute	Part no.	Ver.
Service kit for replacing arcing components. (Before 11/2003).	2607 / 4207 / 6007	1x_	APN340110	R01
	2607 / 4207 / 6007	2x_	APN340110	R02
	8007	1x_	APN340110	R03
	8007	2x_	APN340110	R04
	ALL	EF4-12	APN340110	R05
Service kit for replacing arcing components. (After 11/2003).	2607 / 4207 / 6007	1x_	APN340110	R06
	2607 / 4207 / 6007	2x_	APN340110	R07
	8007	1x_	APN340110	R08
	8007	2x_	APN340110	R09
	ALL	EF4-12	APN340110	R10
Arcing contact	ALL (after 11/2003)	N/A	128 122	R02
	ALL (before 11/2003)	N/A	128 121	
Arc runner back side	ALL	1x_	128 521	R01
	ALL	2x_	128 521	R02
	ALL	EF4-12	128 810	
Arc runner front side	2607 / 4207 / 6007	1x_	128 525	R01
	8007	1x_	128 525	R02
	2607 / 4207 / 6007	2x_	128 525	R03
	8007	2x_	128 525	R04
	ALL	EF4-12	128 815	
Fixed main contact	2607 / 4207 / 6007	N/A	128 110	R01
	8007 with triple terminals	N/A	128 110	R04
	8007 with single terminals	N/A	128 110	R02
Movable main contact	2607	N/A	128 108	R01
	4207	N/A	128 108	R02
	6007	N/A	128 108	R03
	8007	N/A	128 108	R04
Set of protection walls	ALL	1x / EF4-12	128 515/516	R01
	ALL	2x_	129 515/516	R02
Ground insulation	2607 / 4207 / 6007	ALL	128 203	R01
	8007	ALL	128 203	R02
Additional ground insulation	2607 / 4207 / 6007	2x3/2x4/EF4	128 203	R04
	8007	2x3/2x4/EF4	128 203	R05
Spring bar cap	ALL	N/A	128 058	
Upper damper	ALL	N/A	128 018	
Lower damper	ALL	N/A	128 019	
Adapter	2607 / 4207 / 6007	1x_	128 500	R01
	8007	1x_	128 500	R02
	2607 / 4207 / 6007	2x_	128 500	R03
	8007	2x_	128 500	R04
	ALL	EF4-12	128 500	R05
Probe protection cap	ALL	ALL	128 529	
Arc chute	1X2 (1000V)	1x_	128 550	R01
	1X3 (1500V)	1x_	128 550	R02
	1X4 (2000V)	1x_	128 550	R03
	2X2 (2000V)	2x_	128 550	R11
	2X3 (3000V)	2x_	128 550	R12
	2X4 (3600V)	2x_	128 550	R13
	2X2S (2000V)	2x_	128 550	R15
	EF4-12 (3900V)	EF4-12	124 900	R17
Forced tripping release	ALL	N/A	128 640	

1) Check the nameplate to define type

Hints for parts identification:

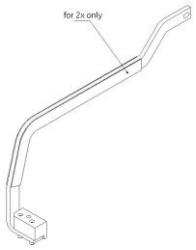


128 122 R02

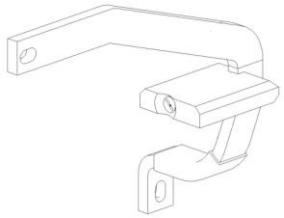


128 121

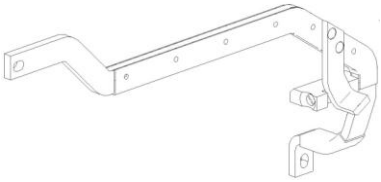
128 810



128 521 R01, R02

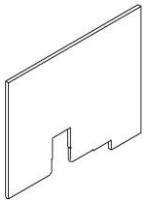


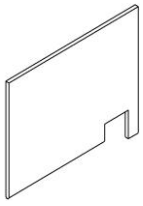
128 525 R01, R02



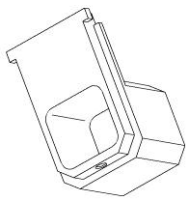
128 525 R03, R04

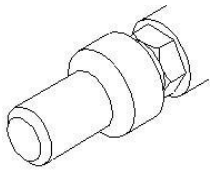
128 815





128 515 R01, R02

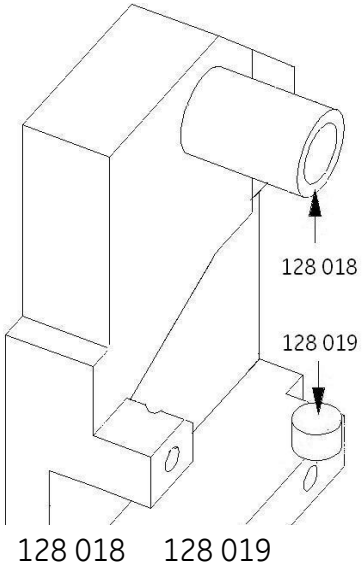




128 529 128 058

6.3.2 Electrical spare parts.

SU control PCB	ALL	N/A	128 700	
ST control PCB	ALL	N/A	128 710	R01
UVR control PCB	ALL	N/A	128 710	R02
Interface plug	External supply 24 V DC ±5%	N/A	128 730	R01
Voltage converter	PCMD 150 24 S24W-GE	N/A	128 730	R02
	PCMD 150 48 S24W-GE	N/A	128 730	R03
	PCMD 150 110 S24W-GE	N/A	128 730	R04
	PCMA 150 70 S24W-GE	N/A	128 730	R05
Standard NEKO PCB	ALL	N/A	128 750	R01
External NEKO 3C PCB	ALL (obsolete)	N/A	128 755	R01
External NEKO 4C PCB	ALL (obsolete)	N/A	128 755	R02
SEL control PCB	2607/4207 for 35 °C ambient	N/A	128 785	R01
	2607/4207 for 55 °C ambient	N/A	128 785	R02
Auxiliary contact	ALL	N/A	174 349	
Shunt trip 24 V DC ±5%	ALL	N/A	128 300	R01
Shunt trip 24 V DC ±20%	ALL	N/A	128 300	R02
Shunt trip 220 V DC	ALL	N/A	128 300	R03
Shunt trip 125 V DC	ALL	N/A	128 300	R04
Shunt trip 110 V DC	ALL	N/A	128 300	R05
Zero-voltage release	ALL	N/A	128 320	R01
Solenoid closing drive	ALL	N/A	128 070	1)
Connector X2	ALL	N/A	DFK-PC 4/12-GF-7.62	
Connector X3, X4, X5	ALL	N/A	DFK-MSTB 2.5/15-GF	



6.3.3 Recommend materials for selected works.

Standard parts, glues, pastes and greases are recommended for a maintenance stock.

Work to do.	Spare parts.	Standard parts, materials and optional components [1].
Arc chute change	Correct version of arc chute 128 550.	**Screws & Washers:** M6x16 – 8.8 (ISO 4762); M6 toothed Rip-Lock, M6 conical spring (DIN 6796).
Arcing contact, arc runners and protective walls change.	Correct version of the service kit APN340110 consist of: - Arcing contact; - Two arc runners; - Two protection sheets; **Optional:** - Mini flexible braid 128 123;	**Screws & Washers:** M6x16 A4 (DIN 4762); M6 toothed Rip-Lock; Retain ring 4 (DIN 6799); Disc spring 12.5 type A (DIN 2093) **Others:** Conductivity grease Alvania RL3 by Shell. **Hint:** Replace 128 123 or 128 150 only if recognize these parts are broken. Replace all the parts from service kit APN340110.
Wiring modifications and control PCB change.	Correct control PCBs or prepared wiring harness.	**Wires:** 1 mm^2, 1.5 mm^2, 2.5 mm^2; 500 V polymer insulation type up to +100 C; RoHS compliant; black. **Plugs:** MSTBC 2.5-5.08; **Terminations:** Crimp MSTBC-MT 0.5-1.0; Crimp MSTBC-MT 1.5-2.5; Receptacles 2.8 mm DIN 46247 with insulation cap;
Dumpers change.	- Damper 128 018; - Damper 128 019; **Optional:** - Spring bar cap 128 058;	**Screws & Washers:** M6x25, M6x30, M8x25, M8x30 - 8.8 (ISO14581); **Materials:** Transparent silicone E-COLL 310ML; glue Locktite 222; thermo paste WLP500;
Changing of zero voltage release / shunt trip	- UV release 128 320; - Correct shunt trip; **Optional:** - Spring bar cap 128 058;	**Screws & Washers:** M6x25, M6x30, M8x25, M8x30 - 8.8 (ISO14581); M4x10 – 8.8 (DIN912); M4 ribbed lock washer (BN791 by Bossard); **Others:** Polyamide clip bands 25x100mm. **Materials:** Transparent silicone E-COLL 310ML; glue Locktite 222; thermo paste WLP500; grease Beacon EP3 by ESSO.

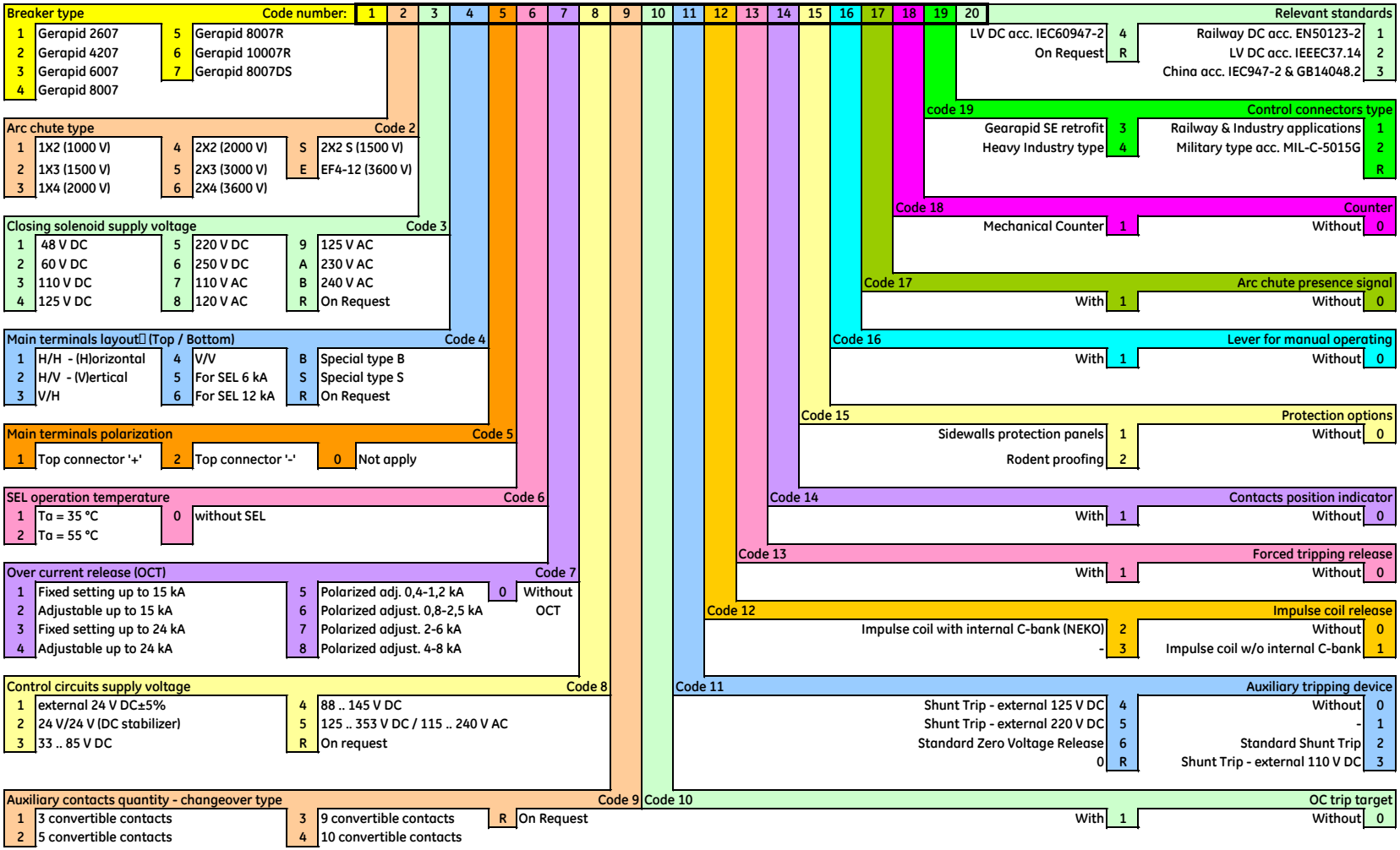
1) For substitute materials please consult GE representative.

7. Customer support

7.1 Options overview.

- The coding system, introduced in 2008, is a catalog configuration tool based on Excel®.
- The catalogue code consists of 20 digits. Each digit represents specific rated value or component.
- **Table 7** shows all available values, components and accessories for the Gerapid breaker family. Detailed descriptions are available in section 3. Please contact GE Sales representative in case of any questions.
- The coding system is valid for Gerapid feeder type (F), rectifier type (R) and disconnector type (DS). This User Manual relates only to standard, feeder type breakers (F).
- Not all of the options from Table 7 are compatible. To avoid improper configurations use the "Gerapid configuration tool" for ordering.
- This Excel® based tool provides a quick and mistake proof configuration with automatic generating of the proper catalogue code and set of characteristics helpful for order description. Ask your GE Representative for details. The number of this tool is: **APN460437**.

Table 7. General options overview for Gerapid breakers.


Code number: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Breaker type
1 Gerapid 2607
2 Gerapid 4207
3 Gerapid 6007
4 Gerapid 8007
5 Gerapid 8007R
6 Gerapid 10007R
7 Gerapid 8007DS
Arc chute type Code 2
1 1X2 (1000 V)
2 1X3 (1500 V)
3 1X4 (2000 V)
4 2X2 (2000 V)
5 2X3 (3000 V)
6 2X4 (3600 V)
S 2X2 S (1500 V)
E EF4-12 (3600 V)
Closing solenoid supply voltage Code 3
1 48 V DC
2 60 V DC
3 110 V DC
4 125 V DC
5 220 V DC
6 250 V DC
7 110 V AC
8 120 V AC
9 125 V AC
A 230 V AC
B 240 V AC
R On Request
Main terminals layout (Top / Bottom) Code 4
1 H/H - (H)orizontal
2 H/V - (V)ertical
3 V/H
4 V/V
5 For SEL 6 kA
6 For SEL 12 kA
B Special type B
S Special type S
R On Request
Main terminals polarization Code 5
1 Top connector '+'
2 Top connector '-'
0 Not apply
SEL operation temperature Code 6
1 Ta = 35 °C
2 Ta = 55 °C
0 without SEL
Over current release (OCT) Code 7
1 Fixed setting up to 15 kA
2 Adjustable up to 15 kA
3 Fixed setting up to 24 kA
4 Adjustable up to 24 kA
5 Polarized adj. 0,4-1,2 kA
6 Polarized adjust. 0,8-2,5 kA
7 Polarized adjust. 2-6 kA
8 Polarized adjust. 4-8 kA
0 Without OCT
Control circuits supply voltage Code 8
1 external 24 V DC±5%
2 24 V/24 V (DC stabilizer)
3 33 .. 85 V DC
4 88 .. 145 V DC
5 125 .. 353 V DC / 115 .. 240 V AC
R On request
Auxiliary contacts quantity - changeover type Code 9
1 3 convertible contacts
2 5 convertible contacts
3 9 convertible contacts
4 10 convertible contacts
R On Request
Code 10
With 1
Without 0
OC trip target
Code 11
Shunt Trip - external 125 V DC 4
Shunt Trip - external 220 V DC 5
Standard Zero Voltage Release 6
0 R
Without 0
- 1
Standard Shunt Trip 2
Shunt Trip - external 110 V DC 3
Auxiliary tripping device
Code 12
Impulse coil with internal C-bank (NEKO) 2
- 3
Without 0
Impulse coil w/o internal C-bank 1
Impulse coil release
Code 13
With 1
Without 0
Forced tripping release
Code 14
With 1
Without 0
Contacts position indicator
Code 15
Sidewalls protection panels 1
Rodent proofing 2
Without 0
Protection options
Code 16
With 1
Without 0
Lever for manual operating
Code 17
With 1
Without 0
Arc chute presence signal
Code 18
Mechanical Counter 1
Without 0
Counter
code 19
Gearapid SE retrofit 3
Heavy Industry type 4
Railway & Industry applications 1
Military type acc. MIL-C-5015G 2
R
Control connectors type
LV DC acc. IEC60947-2 4
On Request R
Railway DC acc. EN50123-2 1
LV DC acc. IEEEC37.14 2
China acc. IEC947-2 & GB14048.2 3
Relevant standards

7.2 Ordering.

Gerapid		with arc chute		APN460437 rev03 09/2009
Quantity		Breaker number:		to
Catalogue no:				
Diagram no:		☐ => Unlock "On Request" options.		
Customer's reference no.	☐ =>	☐ => Special ratings tested by customer.		

	Code Name	Opt	Name	Code	Name	Code
1	Breaker type		Gerapid 2607	1	Gerapid 8007R	5
2			Gerapid 4207	2	Gerapid 10007R	6
3			Gerapid 6007	3	Gerapid 8007DS	7
4			Gerapid 8007	4		
5	[BAU]: code 1					
6	Arc chute type		1X2 (1000 V)	1	2X2 (2000 V)	4
7			1X3 (1500 V)	2	2X3 (3000 V)	5
8			1X4 (2000 V)	3	2X4 (3600 V)	6
9	[LIC]: code 2		2X2 S (1500 V)	S	EF4-12 (3600 V)	E
10	Closing solenoid supply voltage		48 V DC	1	110 V AC	7
11			60 V DC	2	120 V AC	8
12			110 V DC	3	125 V AC	9
13			125 V DC	4	230 V AC	A
14			220 V DC	5	240 V AC	B
15	[STE]: code 3		250 V DC	6	On Request	R
16	Main terminals layout		H/H - (H)orizontal	1	For SEL 6 kA	5
17	Top/Bottom		H/V - (V)ertical	2	For SEL 12 kA	6
18			V/H	3	On Request	R
19			V/V	4		
20			Special type B	B		
21	[ANS]: code 4		Special type S	S		
22	Main terminals polarization		Top connector '+'	1	Not apply	0
23	[POL]: code 5		Top connector '-'	2		
24	SEL operation temperature		Ta = 35 °C	1		
25	[TSEL]: code 6		Ta = 55 °C	2	without SEL	0
26	OC release Threshold [kA]		Fixed setting up to 15 kA	1	Polarized adj. 0,4 kA - 1,2 kA	5
27			Adjustable up to 15 kA	2	Polarized adjust. 0,8 kA - 2,5 kA	6
28			Fixed setting up to 24 kA	3	Polarized adjust. 2 kA - 6 kA	7
29	[KSA]: code 7		Adjustable up to 24 kA	4	Polarized adjust. 4 kA - 8 kA	8
30	Requested marks on the scale		kA kA kA kA kA	kA	kA Without OCT	0
31			kA kA kA kA kA	kA	kA	
32	Control circuits supply voltage		external 24 V DC±5%	1	88 .. 145 V DC	4
33			24 V/24 V (DC stabilizer)	2	125 .. 353 V DC / 115 .. 240 V AC	5
34	[NET]: code 8		33 .. 85 V DC	3	On request	R
35	Auxiliary contacts quantity		3 convertible contacts	1	10 convertible contacts	4
36			5 convertible contacts	2	On Request	R
37	[HIS]: code 9		9 convertible contacts	3		
38	OC trip target		Without	0		
39	[KSM]: code 10		With	1		
40	Auxiliary tripping releases		Without	0	Shunt Trip - external 125 V DC	4
41			-	1	Shunt Trip - external 220 V DC	5
42			Standard Shunt Trip	2	Standard Zero Voltage Release	6
43	[HIL]: code 11		Shunt Trip - external 110 V DC	3		
44	ED impulse coil release		Without	0	Impulse coil with internal C-bank (NEKO)	2
45	[EDA]: code 12		Impulse coil w/o internal C-bank	1	-	3
46	Forced tripping release		Without	0		
47	[ZWA]: code 13		With	1		
48	Contact position indicator		Without	0		
49	[STA]: code 14		With	1		
50	Protection options		Without	0	Rodent proofing	2
51	[SCH]: code 15		Sidewalls protection panels	1		
52	Lever for manual operating		Without	0		
53	[HAN]: code 16		With	1		
54	Arc chute presence		Without	0		
55	[LBM]: code 17		With	1		
56	Counter		Without	0		
57	[ZAL]: code 18		Mechanical Counter	1		
58	Control connectors type		Railway & Industry applications	1	Gearapid SE retrofit	3
59			Military type acc. MIL-C-5015G	2	Heavy Industry type	4
60	[SST]: code 19				On Request	R
61	Relevant standard		Railway DC acc. EN50123-2	1	LV DC acc. IEC60947-2	4
62			LV DC acc. IEEEC37.14	2		
63	[CUS]: code 20		China acc. IEC947-2 & GB14048.2	3	On Request	R
64	Documentation Language		English	En	Chinese	Ch
65	[LNG]:		German	De	On Request	R

7.2.1 Example of order no. 1

Line feeder breaker for LRT substation in Europe; comply with EN50123, with breaking capacity of 50 kA, configured as follows:

1. Load current of 4000 A.
2. Nominal voltage of 1500 V; 2x2 arc chute chosen due to high breaking capacity up to 70 kA.
3. Auxiliary supply voltage of 230 VAC for closing solenoid;
4. Vertical layout of both main terminals (V/V);
5. Breaker polarization not important;
6. Without SEL unit (not available with special terminals);
7. With OC release, adjustable in range of 6 kA...12 kA, with 7 marks on the scale every 1 kA, set at 9 kA;
8. Auxiliary supply voltage of 230 VAC for controls;
9. With 8 auxiliary contacts;
10. With OC trip target;
11. With zero voltage release (UVR);
12. Without electrodynamic tripping device;
13. With forced tripping release for withdrawal operations;
14. With contacts' position indicator;
15. Without sidewalls' protection;
16. With hand lever;
17. Without arc chute indicator;
18. Counter not available;
19. With standard control connectors;
20. Test report according to EN50123-2 standard.

Correct catalogue code shall be: **23A40025R16011010011**

General remarks:

- Please check the "Unlock On Request options" checkbox to enable entering values, which are not listed in this form.
- Please always define the markings number and values for OC release.
- Please choose the "On Request" option to define own OC tripping range.
- Use "On Request" option if available to define own, not standard ratings.
- Any other than first option for connector type are usually dedicated for retrofit purposes. Please refer to special type of connectors' options 2,3,4,R before choosing these. Option 1 is suitable for most applications.

Quantity	1	(max. 60 breakers per order)			Breaker number:		to
Catalogue no:	2	3	A	4	0	0	2	5	R	1	6	0	1	1	0	1	0	0	1	1	En
Diagram no:	36 /102020011																				
Customer's reference no.																					

	Code Name	Opt	Name	Code	Name	Code
1	**Breaker type**			1		5
2			Gerapid 4207	2		6
3				3		7
4				4		
5	[BAU]: code 1	2				
6	**Arc chute type**			1		4
7				2		5
8			1&4 (2000 V)	3		6
9	[LIC]: code 2	3		S		E
10	**Closing solenoid supply**			1		7
11	**voltage**			2		8
12				3		9
13				4	230 V AC	A
14				5		B
15	[STE]: code 3	A		6		R
16	**Main terminals layout**			1		5
17	**(Top / Bottom)**			2		6
18				3		R
19			V/V	4		
20				B		
21	[ANS]: code 4	4		S		
22	**Main terminals polarization**			1	Not apply	0
23	[POL]: code 5	0		2		
24	**SEL operation temperature**			1		
25	[TSEL]: code 6	0		2	without SEL	0
26	**Over current** *Set [kA]*			1		5
27	**release (OCT)** 9,0		Adjustable up to 15kA	2		6
28			On request	3		7
29	[KSA]: code 7	2		4		8
30	Requested marks on the scale.		6,00 kA 7,00 kA 8,00 kA 9,00 kA 10,00 kA	kA	11,00 kA	0
31	Min. 200 A intervals !		12,00 kA kA kA kA kA	kA	kA	
32	**Control circuits supply**			1		4
33	**voltage**			2	125 .. 353V DC / 115 .. 240V AC 230V AC	5
34	[VET]: code 8	5		3		R
35	**Auxiliary contacts quantity -**			1		4
36	**changeover type**			2	On Request 8	R
37	[HIS]: code 9	R		3		
38	**OC trip target**			0		
39	[KSM]: code 10	1	With	1		
40	**Auxiliary tripping device**			0		4
41				1		5
42				2	Standard Zero Voltage Release	6
43	[HIL]: code 11	6		3		
44	**Impulse coil release**		Without	0		2
45	[EUA]: code 12	0		1	-	3
46	**Forced tripping release**			0		
47	[ZWA]: code 13	1	With	1		
48	**Contacts position indicator**			0		
49	[STA]: code 14	1	With	1		
50	**Protection options**		Without	0		2
51	[SCH]: code 15	0		1		
52	**Lever for manual operating**			0		
53	[HAN]: code 16	1	With	1		
54	**Arc chute presence signal**		Without	0		
55	[LBM]: code 17	0		1		
56	**Counter**		Without	0		
57	[ZAL]: code 18	0		1		
58	**Control connectors type**		Railway & Industry applications	1		3
59				2		4
60	[SST]: code 19	1				R
61	**Relevant standards**		Railway DC acc. EN50123-2	1		4
62				2		
63	[CUS]: code 20	1		3		R
64	**Documentation Language**		English	En		Ch
65	[LNG]:	En		De	On Request	R

7.2.2 Example of order no. 2

USA customer wants to buy Gerapid for DC drive application. The customer used to buy Gerapid 8007 according to company special ID code "**GE80071x2R3**". The breaker shall comply with standard IEEE C37.14. Breaking capacity of 200 kA is required and configuration as follows:

1. Load current of 6000 A;
2. Nominal voltage of 800 V;
3. Available auxiliary voltage of 125 V DC;
4. With special design of main terminals as per customer drawing number "**GE8007terR3**". Customer tested breaker in this configuration and test report and drawings were sent to GE for confirmation.
5. Breaker polarization not important;;
6. Without SEL measurement system;
7. With OC release, w/o adjustment possibility. Threshold set at 24 kA;
8. Auxiliary supply voltage of 125 V DC for controls;
9. With maximum possible number of auxiliary contacts.
10. With OC trip target;
11. Shunt trip, with double winding, directly supply from external 125 V DC;
12. With electrodynamic coil and internal C-bank (NEKO control PCB);
13. Without forced tripping release;
14. With contacts' position indicator;
15. Without additional protection covers;
16. With hand lever;
17. With arc chute indicator;
18. Counter not available;
19. With standard terminals for controls connection;
20. According to IEEE C37.14 standard.

Correct catalogue code shall be: **4 1 4 R 0 0 3 4 4 1 4 2 0 1 0 1 1 0 1 2**

General remarks:

- "Special wiring!" indicates, that dedicated electrical diagram will be created for this order. The diagram will be attached to the User Manual as an appendix. Diagrams from the User Manual are not applicable here.
- Customer may call any special identification code that has been used in the past. This will be additional reference number and will be placed on the breaker's nameplate beside of the actual, 20-digit catalogue code.
- Modifications of main terminals according to customer's drawings are possible after agreement with GE and after positive tests results.
- Choosing a double winded shunt trip will limit your available auxiliary contacts number to maximum 8 units.

| | | |

7.2.3 Example of order no. 3

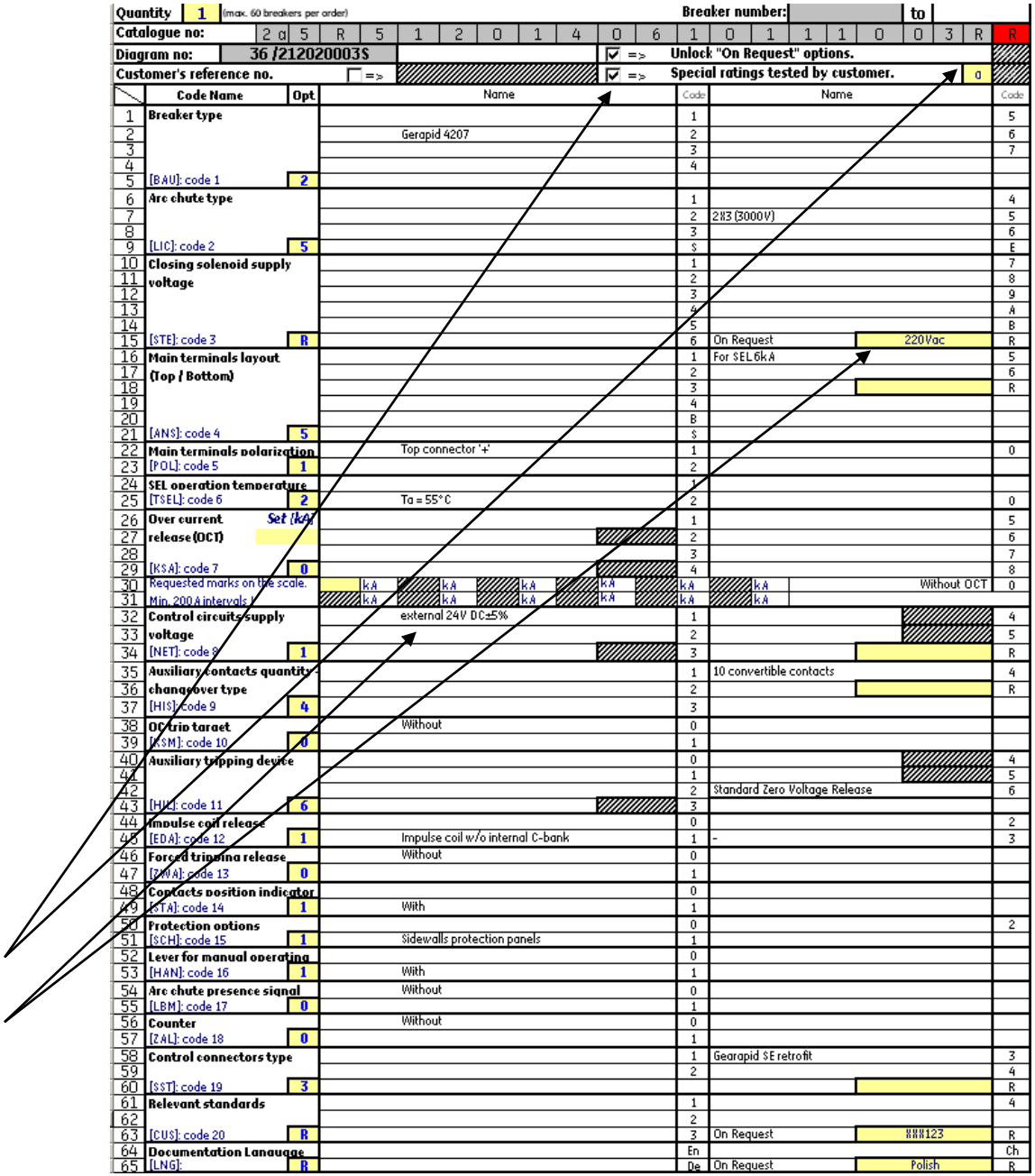
Customer wants to use Gerapid as a field discharge breaker to commutate current from excitation system of synchronous machine to the discharge resistor circuit. Customer has previously tested one Gerapid breaker in a special test sequence using special ratings and internal standard "XXX 123". Customer requests to put on the nameplate rated parameters that have been tested. After agreement with GE both parties decided to create special version of the breaker and assign to it a letter "a" as extension of standard name. These breakers will be a retrofit units replacing old Gearapid SE type.

1 Load current of 3200 A;
2 Operating voltage of 2750 V;
3 High power, low stability, source 220 V AC available for closing solenoid;
4 Terminals suitable to install SEL current measurement system.
5 Plus pole connected to the TOP terminal;
6 With SEL measurement system;
7 Without OC release;
8 Low power, high stability, 24 V DC source available for control supply;
9 With maximum possible number of auxiliary contacts.
10 Without OC trip target;
11 Zero voltage release;
12 With ED impulse release supply directly from external C-bank;
13 Without forced tripping release;
14 With contacts' position indicator;
15 With side insulation panels;
16 With hand lever;
17 Without arc chute indicator;
18 Counter not available;
19 Special retrofit connectors for Gearapid SE breakers;
20 According to IEC 60947-2 standard.
21 User Manual must be in Polish.

Correct catalogue code shall be: **2a5R51201406101110034**

General remarks:

- Customer's special solution with non-typical ratings. Additional letter "a" will be assign to this configuration exclusively. Later customer can use this letter to call the same configuration.
- It is possible to supply closing drive and controls from two separate source of power.



7.3 Glossary

A

a-release – see *Shunt trip device;*
Activating magnet – see *Closing drive*;
Anti-pumping device – see *SU control PCB*. Prevents reclosing after a close-open operation, as long as the device initiating closing is maintained in the position for closing
Arc runners – (also: *arc probes; arc horns). P*rovide safe arc leading into the arc chute. There are two arc runners mounted in Gerapid breaker, front and back.
Arcing contact – – (also: *pre-contact; arcing pre-contact*). An arcing contact on which the arc is intended to be established, to avoid wearing and burning of the main contacts. It is mounted at the top of *flexible band*. It is easy to replace. Spring loaded to maintain proper contact force.
Auxiliary contact – (also: *make/break contact; a-/b-contact, changeover contact, convertible contact). A* contact included in an auxiliary circuit and mechanically operated by the breaker.
Auxiliary switch – (also: *auxiliary switch; make/break contact; a-/b-contact). A* switch block containing up to 10 auxiliary contacts,. Mechanically operated by the mechanism of the breaker during switching operations. Auxiliary switch block is mounted in lower compartment of the control box. Every contact can be either NO or NC, configured by appropriate wiring.

C

Closing drive – *(also: activating magnet; closing solenoid; solenoid drive)*. High power, black solenoid coil, mounted at the front of the breaker, below the control box. Use for electric and remote closing of the main contacts. Power consumption is up to 2.6kW. Closing time is ~150ms.
Closing operation – (also: *switching ON; CLOSE operation).* It is operation, by which the breaker is brought from the OPEN position to the CLOSED position.
Closing solenoid - see *Closing drive*;
Control circuit terminals – (also: *control sockets/plugs*). Fully insulated sockets at the front cover of control box. Intended for external connection to the auxiliary and control circuits.

E

ED coil – (also: *electro-dynamic coil*). An impulse coil release. Actuating element of ED impulse release, mounted on the base, under the mechanism.
Electro-Dynamic impulse release – (also: *ED tripping; impulse release*). Release device, consist of actuator (ED coil) and control circuit (NEKO PCB with C-bank). This is an auxiliary release, activated by high-energy impulse of current. The impulse is shaped by internal (NEKO) or external C-bank. Opening time is less 3ms. Time to charge capacitors is ~15sec.

H

Lever for manual operating – (also: hand *lever*). Hand lever can be used for both, closing and opening manual operation. It is intend for use only during maintenance.

M

Main circuit – (also: *mains; primary circuit; current path*). All the conductive parts of the breaker included in the circuit, which is intend to close or open. It consists of: *main terminals (upper and lower), fixed contact, flexible band and lower bus bar*.
Main terminals – (also: *main connections).* Two conductive bars provided for electrical connection to external main circuit. Different configurations are avaiable.

N

NEKO control PCB – (also: *ED coil control unit; internal C-bank control*). Control circuit PCB to supervise the operation of the ED coil. It consists of control circuit and bank of capacitors. Required to energize the ED impulse coil.

O

OCT – see *Over-Current release;*
Opening operation – (also: *switching OFF; OPEN operation).* An operation by which the breaker is brought from the CLOSED
Over-Current release – (also: *OCT*). An instantaneous and direct acting mechanical release. Tripping the breaker in case of overloads and short circuits. Is adjustable within predetermined range. Opening time depends on short circuit conditions and shall not exceed 5ms. Oct is activated be means of magnetic energy from main circuit. Requires no external control power.

P

Position indicator – (also: *position indicating device).* A mechanical device mounted at the front of closing drive. Indicates whether the breaker is in the open or closed position.
CLOSED position is marked as "I".
OPEN position is marked as "O".
Pre-contact – see A*rcing contact*;

R

r-release – see *Zero voltage release;*

S

SEL – Current measurement system, consisting of sensing element and control circuit. The sensor is an insulated tube, mounted on the top terminal of the breaker. Utilizes two Hall's probes for sensing the current and direction. The proportional voltage signal is transmitted to control circuit, placed in control box. The SEL control PCB is an opto-isolated transducer, which generates standard output signals proportional to measured current.
SEL control PCB – a control circuit PCB. Controls and transforms current measurement signal from SEL sensor.
Self cut-off function– A safety feature provided to avoid overstressing of the closing drive and shunt trip release. Closing drive is automatically cut-off from power source after 500ms. Shunt trip coil is connected in series with auxiliary contact(s), which cause cut-off after breaker's opening.
Shunt trip release – (also: ST; *shunt release; a-release*). Instantaneous release energized by means of voltage signal. Within 50ms trips the breaker's mechanism. Use for remote OPEN operation. ST can be activated by potential free contact or by directly applied voltage from external source. ST can have a single or double winding.
Solenoid drive - see *Closing drive*;
ST control PCB – control circuit PCB supervising the operation of shunt trip release.
SU control PCB – control circuit PCB supervising the remote closing operation by means of solenoid drive. Presents in every breaker, and placed in control box. Provides also *anti-pumping* and *self cut-off* functions.
Switching ON – see *Closing operation;*
Switching OFF – see *Opening operation;*

T

Trip-free device – A mechanical switching device, the moving contacts of which return to and remain in the open position when the opening operation is initiated after the initiation of the closing operation, even if the closing command is maintained. To ensure proper breaking of the current, which may have been established, it may be necessary that the contacts momentarily reach the closed position.

U

UVR control PCB - control circuit, designed as a single PCB, for supervising the zero-voltage release device.

Z

Zero-voltage release – (also: *under-voltage; UVR; r-release*). An auxiliary tripping device. Trips the breaker open on control voltage loss. Opening time is less 75ms. It is used for remote OPEN operation or control voltage supervision. Interchangeable option with shunt trip release. Activated by means of auxiliary "potential free", NO or NC contact.

7.4 Troubleshooting

Breaker does not CLOSE.

A) Closing drive doesn't operate electrically but it is still possible to close the breaker manually by mean of the hand lever.

1) Check the supply voltage of the drive (-X2 :1/:2). The voltage shall not be less than 80% of drive's rated voltage.
2) Check the supply voltage of the controls (-X3 :4/:5). The voltage shall not be less than minimum input voltage required for installed voltage converter
3) Calculate the voltage drop at both supply lines and check for adequate wire size.
4) Check the polarity of the supply connections.
5) Check continuity of the control connections.

Open the control box:

WARNING ! Following operations are done with control voltage connected. Only trained specialist or GE Service representative shall perform them. Risk of electric shock!

6) Check if the PCBs' plugs are connected and screwed.
7) Check if there is 24 V DC available at output of the voltage converter. Check -X10 (:8:9:10) / (:6:7).
8) Check the status of the red LED diode on the SU PCB.
   - Does not light – power supply failure;
   - Weak light – system ready to CLOSE;
   - Intensive red light – system not ready to CLOSE. Closing STOP circuit is active, or NEKO PCB is not charged, or "anti-pumping" is active for 15 sec.
9) Check if the Closing STOP circuit is not open. Measure voltage at SU PCB, (-X12 5:/:6). There shall be ~24 V DC available for actuation of "closing stop relay". If there is no 24 V DC, check continuity of closing STOP circuit. Check relays at ST/UVR/NEKO PCBs, by controlling state of contacts at points :5/:6 of each.
10) Replace any ST/UVR/NEKO if necessary.
11) Replace the SU control PCB.
12) Switch OFF the power at control box! Check continuity and resistance of solenoid winding. Replace the solenoid in case of winding breakage.

Contact GE Service in case the problem is not solved.

B) Closing drive operates electrically, but it is not possible to keep contacts closed.

1) Check the forced tripping release (if installed). A permanently blocked tripping device, during closing operation, will cause closing failure and force contact opening.
2) Check contact system area. Look for any parts that may be stuck between contacts or into mechanism module.
3) If the zero voltage release is installed, check connection of (–S2) pushbutton. If only NO type (-X2 :6/:7) is used, be sure that (–X2 :8/:9) is shorted.

Open the control box (only when UVR is installed).

4) Check the wiring connections for UVR PCB.
5) Check supply of the UVR control PCB (-X13 :7/:8)

Contact GE Service in case the problem is not solved.

Breaker does not OPEN.

WARNING! Below operations are done with control voltage connected. Only trained specialist or GE Service representative shall perform them. Risk of electric shock!

A) Shunt trip does not operate. Breaker is able to CLOSE and OPEN by means of hand lever.

1) Check points A2 to A5.
2) Check the self cut off contact HS11 (-X14 :1/:2).
3) Check the wiring connections and supply line of ST PCB (-X14 :7/:8).
4) Check the continuity of shunt trip coil (-X14 :9/:10).
5) Replace the ST PCB or ST coil if necessary.

Contact GE Service in case of problem is not solved.

B) Zero voltage release does not operate. Breaker is able to CLOSE and OPEN by means of hand lever.

1) Check points A2 to A5.
2) Check point B3 to B5.
3) Check the continuity of UVR's coil (-X13 :9/:10).
4) Replace the UVR PCB or UVR coil if necessary.

Contact GE Service in case the problem is not solved.

C) ED impulse releasedoes not operate. Breaker is able to CLOSE and OPEN by means of hand lever.

1) Check points A2 to A5.
2) Check the wiring connections and supply line for NEKO PCB (-X16 :1/:2).
3) Check the voltage level and timing of firing signal for releasing the C-bank energy (-X16 :3/:4). Voltage signal shall be between 6-24 V DC and duration of minimum 3 ms.
4) Check if the NEKO is signaling C-bank charging correctly (-X16 :9/:10). Relay is closed when NEKO is ready to operate.
5) Check the continuity of ED coil (-X16 :11/:12).
6) Replace the NEKO PCB if necessary.

Contact GE Service in case the problem is not solved.

7.5 GE service teams

Germany

GE Consumer & Industrial
Berliner Platz 2-6
24534 Neumünster
T +49 180 4 437378
F +49 4321 201 490
E service.g@ge.com

Netherlands

GE PowerControls NL
Parallelweg 10
7482 CA Haaksbergen
T +31 53 573 03 03
F +31 53 572 63 15
E service.nl@ge.com

Spain

GE Power Controls Spain
Marques de Comillas
08225 Terrassa
T +34 93 736 5742
F +34 93 789 0943
E service.e@ge.com

UK

GE Power Controls UK
Foundry Lane
Widnes
T +44 1162905271
F +44 151 420 9634
E service.uk@ge.com

Poland

GE Power Controls
Leszczynska 6
43300 Bielsko-Biala
T +48 33 828 6343
F +48 33 811 8702
E service.pl@ge.com

Asia

GE Consumer & Industrial
900 Yishan, building C
200233 Shanghai
T +86 21 2401 3033
F +86 21 5423 5339

North America

GE Consumer & Industrial
510 East Agency RoadWest
Burlington, Iowa 52601
T +1 888-437-3765
F +1 319-753-8479

France

GE Power Controls France
1572, route de Guise
02100 Harly (Saint-Quentin)
T +33 3 23 50 70 66/67
F +33 3 23 50 70 65
E service.f@ge.com

Italy

GE Power Controls Italy
Via Monte Avaro 7
24060 Chiuduno Bergamo
T +39 35 83 63 321
F +39 35 83 63 301
E service.it@ge.com

Belgium

GE Power Controls Belgium
Nieuwe Vaart 51
9000 Gent
T +32 9 265 21 11
F +32 9 265 28 12
E service.b@ge.com

7.6 Notes

GE Consumer & Industrial GmbH
Berliner Platz 2-6
D-24534 Neumünster
Germany
Phone: ++49 4321-201-0
Fax : ++49 4321-201-444

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